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# THE SURGICAL CLINICS OF NORTH AMERICA

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Volume 1

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## CLINIC OF DR. HOWARD LILIENTHAL

Mt. SINAI AND FLOWER HOSPITALS

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### EXTRIPATION OF A DERMOID CYST OF THE MEDIAS- TINUM

TODAY I hope to perform the final step in a series of operations upon an extremely unusual case.

When this young woman was first seen by me in the spring of 1919 she was in the Tuberculosis Department of Bellevue Hospital. She was twenty-eight years old. I saw her as consultant at the request of Dr. James A. Miller and Dr. Henry E. Hale. She stated that she had been healthy until about a year before, when, following an influenza, there was cough and slight expectoration of dark brown mucoid substance. The x-ray examination at Bellevue Hospital resulted in the diagnosis of probable pulsating encysted left empyema on the mediastinal side, and it was with this diagnosis that I was asked to see her. Exploratory puncture had been made and a little mucoid fluid containing dark minute masses of pigment was withdrawn, but with little effect on the patient's condition. She left the Tuberculosis Department because there was no evidence that she was suffering from this disease, and entered Mt. Sinai Hospital on October 28, 1919. Her general appearance was that of a delicate girl. There was slight cough, the temperature was 100° F., the pulse 96 and respirations 24. The physical examination showed dulness from the central line to the left anterior axillary line, and at the fifth rib dulness continuous with that of the heart. In this region breathing and voice sounds were absent. There was no fremitus and nothing else remarkable was found in the chest.

The urine showed no disease. The x ray demonstrated a semi-circular shadow in the middle two-thirds of the chest extending outward from the mediastinum almost to the axillary line (Fig. 669). There was no pulsation on fluoroscopy although pulsation had been clearly seen at Bellevue Hospital a few weeks



Fig. 669.—Delayed rise of mediastinum. Note large semi-circular shadow its base toward the mediastinum.

before. The left diaphragm was adherent to one point with the patient lying on her right side the mass fell away from the chest wall, disclosing a slightly hairy area between it and the ribs as if from attenuated adhesions. The outline of the shadow was sharp and there was no area of infiltration in the surrounding lung. The heart was pushed over 1 inch into the right chest

All sorts of diagnoses had been made pulsating sacculated empyema and aneurysm of the aorta being the favorites. Dr Harry Wessler at Mt. Sinai Hospital, suggested that the tumor was probably a dermoid and that it arose from the mediastinum. For more than nineteen years we had waited in this hospital

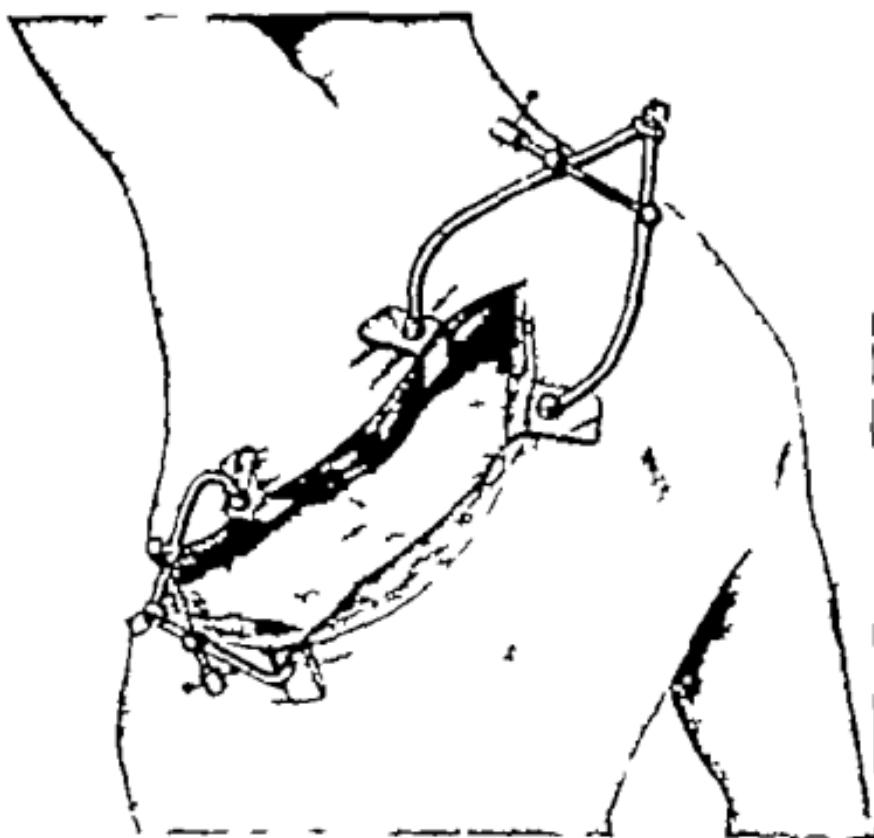


Fig. 660.—Showing Lillenthal's rib-spreader in use. Only one of these instruments is usually necessary. In the case of Miss D. C., where no rib was cut, only one was used. In that of C. McK., however two spreaders had to be put in. (The instruments are shown too small in the drawing.)

for our second case of dermoid cyst of the mediastinum the first one having been operated upon by Dr A. G. Gerster the almost moribund patient dying soon afterward. The cyst had become infected and had perforated the chest wall and the operation was a manipulation for drainage. Our patient of

today was more promising, with no sign of infection and with youth and good general condition in her favor.

Bronchoscopy was performed by Dr. Yankauer who stated that the lumen of the left main bronchus was distorted from pressure by an extrabronchial mass, the pressure appearing to come from the front and outer side. No evidence of lung abscess was seen.

On November 6 1919 I operated Dr. William Branower administering gas, oxygen, and ether by the intrapharyngeal method and Dr. Harold Neubof assisting. An incision was made from near the costal angle in the seventh interspace forward and downward to the costal cartilages and the rib-spreader was put in place (Fig. 669). No rib was cut. The spreader gave a perfect exposure and, at first, with the lung expanded by the intrapharyngeal differential pressure little was seen of the mass, most of which was covered by lung. Separating the lobes, however a tumor the size of a baseball, bluish, translucent, and evidently cystic, was seen occupying the location described in the x-ray report. It had extended into the upper lobe of the lung until it appeared anteriorly where the lung gradually thinned out, so that the mass itself was visible for the space of about the size of a silver dollar.

After aspirating about an ounce of thin mucoid substance containing brown grains an unsuccessful attempt was made to enucleate the tumor and during the attempt the thin sac was ruptured. Immediate microscopic examination of the fluid showed a few white cells. The cyst also contained considerable brown, sebum-like substance in flakes, and at the posterior part of the sac there projected into its cavity two polypoid masses each about the size of an adult thumb. One of these was cut away as a specimen, and it clearly consisted of skin covered with short hair. There was no bubbling or other evidence of connection with the respiratory tract. The cyst apparently sprang from the mediastinum. It was semiglobular in shape the base occupying an area upon the pericardium so densely adherent to this delicate membrane that all idea of dissecting it away was abandoned. Mansuflation was now decided upon as a tem-

porary measure, and by suturing I reduced the size of the opening into the cyst and fastened it to the chest wall. A small resection of the ninth rib posteriorly was made for tube drainage of the pleural cavity another tube was placed in the hollow of the cyst, and the main intercostal thoracotomy wound was closed with three chromicized catgut pericostal sutures and the usual closure in layers. The ribs easily came together.

The operation had been very well borne, the patient's color remaining excellent throughout. After the closure of the chest the lungs were inflated through the anesthesia tube and the tightly fitting drainage-tube was clamped so as to maintain normal intrathoracic negative pressure. When the patient was in bed the lower tube was connected with a longer one the end of which lay under lysisol solution in a vessel under the bed. Scarcely any reaction followed this operation. A small quantity of bloody serum was discharged from the pleural cavity through the suction-tube and about 2½ ounces of bloody fluid were aspirated by syringe through the tube lying in the cyst itself.

Five days after the operation the patient was out of bed, and on November 23d, twenty-six days after operation, she was sent home with the opening into the cyst still present. The main wound had healed primarily.

I hoped that there would form a narrow channel lined completely with epithelium from the skin of the chest to the lining of the dermoid and that the secretion would become insignificant and sebaceous in character so that the danger of a radical operation such as we are about to do today for extirpating the sac might be avoided. However it became necessary to have her readmitted in order to dilate the rapidly contracting fistula, and on December 20 1920 in local anesthesia with novocain and adrenalin, an incision was made along the front part of the old scar and the rib above the sinus was subperiosteally resected for about 1½ inches. The wall of the tract was incised toward the left side and rapidly dilated with the finger. The cavity was then cureted and packed with gauze. Two days later the gauze was removed and one large and one small drainage-tube were inserted merely to keep the orifice wide. The discharge

however continued and necessitated frequent dressings, so it was seen that something else would have to be done.

The patient, Miss C., was presented at a meeting of the New York Society for Thoracic Surgery and suggestions were requested as to the subsequent conduct of the case. Dr Willy Meyer believed that before risking an operation for the extirpation of the tract an attempt should be made to destroy the lining by chemical means. This attempt was made, using a fluid containing 10 parts of zinc chlorid, 10 parts of sulphate of copper and 80 of water. Applications were made a number of times, but always there was considerable febrile reaction and much pain. Apparently the cutaneous lining of the cyst contained sensitive nerve-endings. Various antiseptics were then employed and gradually the opening recontracted, but the discharge was purulent and infected with *Bacillus pyocyanus* and the daily dressings were terribly annoying. Miss C. who always was a good sport, expressed her willingness to take any chances that I was willing to take if only she might be finally rid of this troublesome condition so long and patiently borne although she knew quite well that the actual danger to life from the presence of the cyst with its almost certain enlargement had been done away with in the first operation. So here we have her once more on the operating table with Dr Harry Goldman administering the ether. Remember it is a year and four months since my first operation.

First we will irrigate the cavity with sterile water then we will wash it out through a catheter using strong alcohol so as to dry the lining of the cyst. The probe as you see shows that the sinus runs upward and inward toward the median line to what seems to be a truly dangerous depth. We now fill the cavity with a strong aqueous solution of methylene-blue in order more sharply to differentiate the appearance of the cyst lining from the surrounding tissue. With the scalpel I will incise the skin parallel with the line of the sinus upward and curving around the outer border of the left mamma which must be dissected up and retracted so as to expose clearly the bony chest wall (Fig. 670). I now take the large Liston bone forceps

and remove a section of the ninth rib then of the eighth, and then of the seventh, which should give us plenty of room. I greatly fear wounding the pleura or even perhaps the pericardium, but these dangers are unavoidable. We now have the pleura before us and it is clear that in spite of all our precautions we have entered its cavity at one minute point. As you see however it can be nicely closed by two catgut sutures so that



Fig. 670.—Miss D. C. Final photograph showing wound soundly healed, anterior and lateral portion. The perimammary part is the scar resulting from the wound made at the time of the open clinic here reported.

all hissing and bubbling have disappeared. We shall now open the sinus from below upward and the walls of our wound can be retracted. The lining membrane of the cyst is brought clearly into view you see that, after all, it has not taken the blue dye but has retained the color of skin. This is probably because of the presence of an abnormal coating of sebaceous material so common in the skin of dermoid tumors. However this skin is so white and its structure so characteristic that we

shall have no difficulty in recognizing it in all the nooks and corners of this wound. With mouse-tooth forceps and scissors we will now dissect away every particle of skin which we can see. The job is far from being an easy one and becomes a bit tedious. I see that in addition to having wounded the pleura we now have a slit about  $\frac{1}{2}$  inch long in the pericardium, so that the heart itself can be seen by holding the lips of this slit apart with forceps. But, fortunately here again we are able to correct the



Fig. 671.—Showing posterior portion of scar in the case of Miss D. C.

defect with a couple of fine chromicized catgut stitches. I do not believe that there will be infection in the pericardium from this opening because we have so carefully washed out and disinfected with alcohol the cyst cavity. In order to be sure, however we will swab out the entire wound with tincture of iodin and pack it with iodoformized gauze. The cutaneous wound seems larger than it need be so we will close the upper portion with a few metal clips.

The patient has stood the operation extremely well. The breathing is quiet and the pulse steady. A dry dressing and bandage will now be applied and the patient will be sent back to bed.

**Postoperative Notes.**—A reaction with fever up to 102° F followed this procedure. In a few days the Carrel-Dakin method of wound disinfection was instituted, and then there was rapid progress, so that the patient was discharged with a narrow slightly discharging sinus about April 5 1921. Soon after this the sinus closed.

She was seen today (September 21 1921). She had had a good summer and had gained 30 pounds in weight, probably because of the mental relief. Figures 670 and 671 show the condition of the scars today.



## SUPPURATIVE BRONCHIECTASIS SINGLE-STAGE LOBECTOMY

The case before us this morning is fortunately an unusual one, and yet not so rare as would be apparent from the literature of pulmonary suppurations. I feel convinced that suppurative bronchiectasis is frequently mistaken for other diseases, the commonest of which is tuberculosis. Even this patient, Mrs. A. M. twenty-six years old, a Spanish native of one of the islands of the West Indies, has been treated for tuberculosis and was kindly referred to me by Dr. Bertram Waters, of the Loomis Sanatorium where the proper diagnosis was made.

I fear it would bore you to go into the details of the pathology of cases requiring a resection of the lung for suppuration. Roughly speaking however they may be divided into two classes first the true chronic suppurative bronchiectases which have usually existed for many months, and often years, before the patients are willing to take the desperate chance of this kind of surgery and second the bronchial and peribronchial suppurations in which true abscesses, often multiple are present. Perhaps the commonest cause of chronic lung suppuration confined to a single lobe or a part of a lobe is the aspiration of a foreign body although, of course a breaking-down pneumonia may terminate in a condition of this kind. No absolutely sharp line can be drawn between the multiple lung abscesses and the suppurative bronchiectases although each individual case will show conditions which classify it as either multiple abscess or bronchiectasis. Following tonsillectomy performed in general anesthesia suppuration in a single lobe is commoner than most throat specialists are willing to admit. To be sure some of these patients, especially children, get well without operation, and their cases are put down as "postoperative pneumonias" but too frequently the disease becomes chronic and incurable by any means except surgery. It is supposed that during the

anesthesia a bit of septic blood-clot or infected tissue from the throat is sucked into the respiratory tubes and forms the starting-point of infection. Unless the case is absolutely clear (and most of them are not) I think that an examination by the bronchoscope should be made. This will check up the appearances shown by the x ray and the two together form a valuable method for accurately localizing the lesion.

Dr. Sidney Hankauer performed the bronchoscopy here and he stated that the trouble was unquestionably confined to the left lower lobe. An artificial pneumothorax had been induced in the sputum, and before the bronchoscopy it was necessary to withdraw the gas with an aspirating needle. Artificial pneumothorax has been employed many times for the relief or cure of pulmonary suppuration, and occasionally it is followed by great benefit, but usually the diseased part of the lung is so much less compressible than the healthy part that the gas merely prevents the functioning of the normal parts, making little if any compression upon the diseased portions.

This patient's general condition appears to be excellent. Her nutrition is good her bowels have moved regularly her tongue is clean. Her disease began following an influenza in December 1918. Then came the characteristic signs and symptoms of a chronic pulmonary suppuration with the daily discharge of large amounts of foul, purulent matter occasionally streaked with blood. Tubercl bacilli were absent from the sputum.

It is my intention now to open the chest by a long inter costal incision, and I shall probably content myself in this stage with merely loosening the adhesions around the diseased lobe and trying to cause adhesions to form around the upper lobe, so that in the second stage of the operation a week from now the upper lobe will not collapse while we are operating upon the lower but will remain fixed to the chest wall. We shall then not even require the intrapharyngeal differential pressure which you see being used today by our anesthetist D. Branower. The adhesions are made to take place by rubbing the visceral and parietal pleura with gauze and by laying on a single layer of iodoformized gauze between the lung and chest wall, removing

this gauze in forty-eight hours as suggested by Dr. Samuel Robinson of Santa Barbara. Quick adhesion follows.

The patient is now being placed in the proper position for this operation. She lies upon her right side, slightly upon her



Fig. 672.—Anterior view illustrating position of patient prepared for operation upon the right lung. (This is not a picture of the case here reported.) The bridge of the table is elevated so as to cause scoliosis and heavy sand cushion keeps the patient from rolling upon the abdomen.



Fig. 673.—Posterior view of same as Fig. 672. The arm does not necessarily hang beside the table. Its position should be changed from time to time.

face, the legs and thighs flexed, and the posture is maintained by bandages and sand-pillows (Figs. 672-673). Now the bridge

of the table is elevated so as to cause a scoliosis toward the left, widening the intercostal spaces. The patient has been anesthetized with ether but soon this will be replaced by nitrous oxide and oxygen, only a little ether being occasionally employed to deepen the narcosis and to secure better relaxation. The entire left half of the chest is now brown with iodin and the drapings are in place.

I make the skin incision, a long one in the seventh inter space from behind the angle of the ribs almost to the costal cartilages, and now I continue the posterior part of the incision upward behind the scapula and parallel with its border. The muscles are quickly divided, the vessels being caught whenever possible by forceps before they are cut. At last we are down to the ribs and intercostal tissue and the first portion of the incision is carefully deepened, holding the knife close to the upper border of the eighth rib so as to avoid the intercostal artery. I do not anticipate the presence of asbestos in the upper part of the chest because the x ray has shown that this part of the lung easily collapses. The warning that we are about to enter the pleura is passed to Dr. Branower so that he may begin differential pressure. Now we carefully incise the pleura and, as you see there is a total absence of the in-and-out rush of air which almost invariably occurs in the absence of positive pressure. The patient breathes quietly the lung remains gently distended and follows the motions of the chest wall. I now rapidly enlarge the incision into the chest as far back as the angle of the ribs and quickly resect with my large bone forceps of the Liston type about 7 inches of the eighth rib together with its enveloping periosteum. Through the vertical posterior part of the wound narrow sections of the sixth and seventh ribs are rapidly removed with the forceps. There is so much room that it is simple to catch such vessels as bleed but you are probably surprised to note that there is scarcely any bleeding from the intercostals. The reason is that the forceps is used with the blades at right angles to the plane of the rib so that the rib is cut by the blade of the forceps impinging upon the upper and lower margins of the bone instead of in the usual

way (Fig. 674). Also I cut the bone slowly and this crushes the intercostal structures instead of cutting them, and the artery seldom bleeds. We will now put in the rib retractor and spread the wound widely which gives us an excellent view of the entire left thorax. It is at once evident that the lower lobe is seriously diseased. Its color is dark and it moves but little on respiration. On palpation I find that it feels quite solid, and even the edge of the upper lobe shows a few small discolored patches suggesting that here also there are possibly small areas of consolidation. To my surprise I find no important adhesions of the lung to the chest wall. You see this filmy membrane connecting the lower lobe with the great vessels posteriorly? It

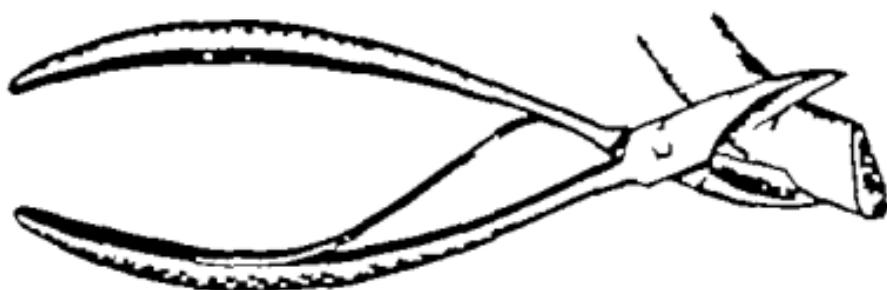


Fig. 674.—Method of cutting rib with periosteum so as to prevent bleeding from intercostal vessels. Also, it is easier this way.

looks as if it were congenital and not due to infection. It appears to me that we have here conditions which make it most tempting to complete the operation in one stage. Indeed I am afraid that by dividing the operation into two stages we shall only add to the difficulties on account of new adhesions where we do not want them. So we will get on with the work and finish the extirpation at once. The patient thus far has lost hardly any blood her color is good. Dr. Branower tells us that the pulse and respiration are satisfactory. Between ligatures of catgut I now divide the filmy adhesion which I have just demonstrated, and you see I have the lower lobe in my hand with my fingers surrounding its pedicle which is composed of

the vessels, nerves, and bronchi which supply the lower lobe all matted together by chronic inflammatory indurated tissue. I will now pass ligatures of strong silk through this pedicle with the aid of a stout hemostatic needle, and I cut that part of the pedicle which has been constricted by the ligature, leaving a stump about an inch long. I now pass another ligature through another section of the pedicle and divide this as I did the first

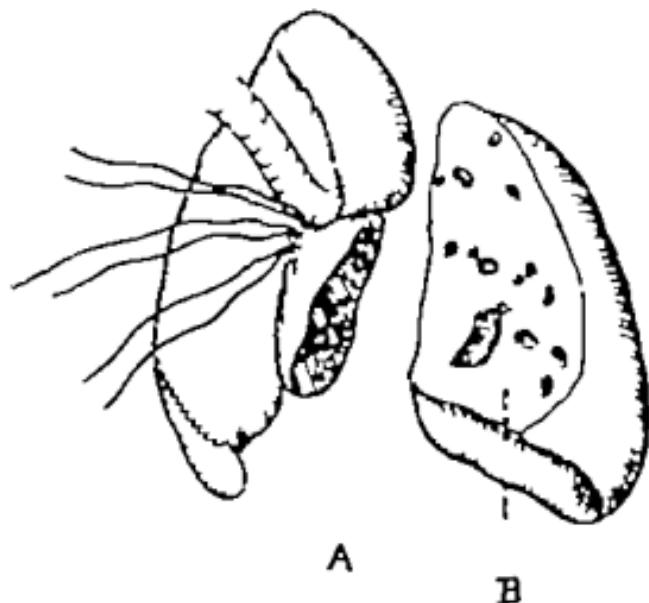


Fig. 675.—Diagrammatic drawing to illustrate method of lobe resection. Note the ligatures of silk with the ends left long. *A* is the surface of the very generous stump which is left when the lobe is cut away. It shrinks to *one-half as much as it has been cut through*. *B*, the corresponding surface of the resected portion, expands in area when the lobe is severed from its attachment. The stump, of which *A* is the section, shrinks and comes away with the ligatures.

one (Fig. 675). But little gas appears as I divide the pedicle, and this is taken care of by our suction machine and by sponging. You see I have had to insert eight of these suture ligatures, and now I am at the last bit of tissue which holds the lobe. Dividing this, we have the specimen in our hand (Fig. 676). I have not cut any of my silk ligatures short and they have all been left long enough to protrude from the wound when it shall

have been closed. I do this so as to steady the mediastinum by fastening the protruding ligatures in place with moderate tension, using a large safety-pin outside the chest wall to transfix



Fig. 676.—Diseased lung specimen in the case of Mrs. M. Note greatly dilated bronchi.

the mass of silk threads. The rapid flapping to-and fro motion of the unsupported mediastinum is an extremely dangerous thing but it requires only a light traction to hold the mediastinum steady and to permit easy respiration. Examining the stump

now I see that there are a number of greatly dilated bronchial openings. We will disinfect each of them with a drop of pure phenol. At the suggestion of Dr Neuhof who has so skilfully assisted me during this work I shall make a small opening in the middle of a large piece of rubber-dam and through this opening I shall draw the ligatures so that the stump may be pulled through the hole also and thus in a measure be isolated from the remainder of the chest cavity. You observe this has worked out very nicely and I will lightly fill this rubber bag with iodoformized gauze. Before closing the chest it is necessary to make a counteropening in the lower part of the back through which a drainage-tube shall be led from within the chest to a vessel of antiseptic solution beside the bed when the patient shall go back to her room. Therefore I make this little opening posteriorly above the tenth rib and I select a piece of drainage-tube so large that it will fit air tight. We will now close this large wound. First the ninth and seventh ribs are drawn together by pecten suture of strong chromicized catgut, then the muscular layers are brought together with small chromicized catgut put in by interrupted suture. A sufficient number of these sutures are inserted to make the wound air-tight so that sucking does not take place but I have learned that it is dangerous to close the skin in cases of this kind. There is always sure to be a certain amount of infection, often from anaerobes which are present in the bronchi and if drainage is not most thorough a quickly fatal infection may occur. You will note that I am burying the safety-pin, the gauze, the rubber-dam and the ligatures beneath the layers of muscle, for I wish to have the chest air tight except at the place where the drainage-tube protrudes, and this will be taken care of by the immersion of the tube as just described. In a few days I hope to expose them by removing the overlying stitches. The patient by this time will have adjusted herself to the strange pneumatic conditions. Dr Branower now makes a gentle intrapharyngeal pressure and I will hold the end of the tube beneath the surface of water. Bubbles appear. Now they have ceased, and I clamp the tube for the time being until the patient shall be back in bed. You

see her condition is excellent her color is good her pulse only about 110 and of good quality

**Postoperative Note.**—Twelve hours after the operation there was a sharp reaction, with temperature of 104 F a not unexpected phenomenon in cases of this kind. Her pulse was strong and about 130 in rate. This postoperative hastening of the pulse is also usual often it runs as high as 160 but this need not cause alarm so long as the tension is sufficient. Thirty-six hours postoperative however the patient's condition was not so favorable, although she was strong and able to cough and expectorate mucus without effort. The sputum was no longer purulent and the foul odor had gone. There was, however some cyanosis and dyspnea on comparatively little effort such for example, as changing the dressings. Then there appeared a complication which I had never before seen in any of these cases. I have performed lobectomy twenty-three times with eleven deaths the surviving patients being as a rule entirely cured and I have noted most of the postoperative symptoms pretty closely. Here, however there was something new. An almost continuous belching of enormous quantities of gas accompanied by brownish-black, foul fluid brought up in small amounts.

There was tremendous abdominal distention and in spite of gastric lavage and the usual efforts at stimulation the patient did not rally. The abdominal distention was at first relieved by a rectal tube with irrigations, but the belching continued until she died about fifty-nine hours after the operation. This belching was something entirely new to me. The quantities of gas were enormous almost unbelievable and unfortunately we were not able to discover the actual cause of death because no postmortem examination was permitted. The abdomen had not been invaded in the slightest degree at the operation, and I was at a loss for a diagnosis. One of the nurses had noted during the cleansing of the patient's mouth that there was an ulcer on the right side of the tongue about two-thirds of the way back and the patient stated that she had had this ulcer 'for a long time.'

A few days after the death of the patient Dr. Neuhof hap-

pened to meet a physician who resided in the tropics who stated in regard to a fatal abdominal case of Dr. Neuhof's that he believed that the disease from which Dr. Neuhof's patient died was sprue which is endemic as a visceral disease in the West Indies. A fatal exacerbation of the condition, pentomitic in character frequently occurs after any serious operation, no matter what its character may have been, and in the Antilles this is so well known that in the presence of sprue one does not operate except in emergencies. Dr. Neuhof suggested that this might have been the case with my patient, and I then recalled the indolent ulcer of the tongue. Unfortunately no culture was made. As soon as I knew of the possible complication of sprue I requested Dr. Aschner who had the lung specimen for examination, to try to isolate the *Monilia*. This, however was impossible because the specimen had already been put into an antiseptic preserving solution.

## CHRONIC LEFT EMPYEMA WITH THORACIC FISTULA. MAJOR THORACOPLASTY AND LUNG MOBILIZATION

Our patient today is a youth of sixteen tall and well developed, but, as you see, frightfully scoliotic from a contracted left thorax the result of long-continued suppuration in the left pleural cavity. He was sent to me by Dr J. Knox Simpson of Jacksonville, Florida and I first saw him only two days ago. His thoracic troubles began at an early age, for when he was but eighteen months old he had a left-sided pneumonia. His tonsils and adenoids were removed five years ago. On February 1st of last year he had influenza with pneumonia, followed by a left empyema, which was operated upon by intercostal thoracotomy in March of the same year. He was relieved but the wound never closed in spite of the best of care. The following autumn he was treated by the Carrel Dakin method for ten weeks, but without radical change in his condition. During the ten weeks he received instillations every two hours.

At the time of his first visit there was profuse discharge and to make himself comfortable he wore a tight-fitting tube clamped so as to prevent the outflow of pus except at the time of the dressing. I found the fistula in the left axillary line in the seventh interspace. The condition is well demonstrated in this x-ray plate (Fig. 677). You will note the great scoliosis, the large irregular pneumothorax in the left chest, and the pleural thickening.

In spite of this boy's mature development I believe there is still time to correct in part at least the scoliosis by operating upon his chest and closing his sinus.

Dr Harry Goldman is administering the anesthetic for us and is using nitrous oxide and oxygen with a little ether. He has the necessary apparatus for intrapharyngeal insufflation should it become necessary.

The patient is placed upon his right side and the bridge of the table is elevated so as to give as good access as possible to

the intercostal space where we expect to begin our incision. This position is a very important factor in securing a free exposure of the thoracic cavity. It is better to spend a little time in getting the patient exactly in the right position than to have to shift him about later on. In opening a thorax of this kind in the presence of a sinus I pay no attention to the location of the opening of the fistula, but prefer to make my incision as if no



Fig. 677.—Case of C. M. K. This picture shows the erosion, the great contraction of the left chest, and the empyema cavity represented as pectenothorax.

wound were present. If the fistula happens to be in that inter space which seems most advantageous for the first incision, I go right through it; if not, I enter the chest above or below it, as the case may be. In the present instance you see I have made my skin incision between the seventh and eighth ribs, the sinus being one space above. You will note that my incision begins well behind the costal angles and extends forward almost to the

cartilages. The *serratus magnus* and *latissimus dorsi* are divided and the vessels crossing the incision are quickly clamped on both sides of the wound. We are now down to the ribs and I find the seventh much deformed on account of the long presence of the tube, which has caused osteomyelitis with bone production. I can see already that we shall not have room in this contracted chest to expose all the recesses unless we divide some of the ribs, so I quickly extend the incision up along the posterior border of the scapula dividing skin, trapezius, and rhomboid muscles and then with a large-sized Liston's forceps I divide the sixth and fifth ribs posteriorly and insert two rib-spreaders one in the original wound, the other between the cut ends of the sixth and fifth ribs (Fig. 669). In this way we gain a perfect exposure of the cavity. You will see that it is smooth walled but irregular in shape, and it evidently is of about 500 c.c. capacity. The glistening lining grayish in color is not as thick as we often find it in these cases probably because of the long treatment with Dakin's solution which has dissolved much of the exudate, but the lining is extremely tough and extends equally over the visceral and parietal pleura, so that all landmarks are obliterated.

Under the guidance of the eye I now make an incision with the scalpel beginning at the uppermost part of the chest directly upon the lung side and this incision extends down to the lower most part of the cavity. Ordinarily one would expect this incision, which completely divides the exudate to spread with the respiratory movements of the lung and this, you see, is the case here. The incision has become spindle shaped and about  $\frac{1}{2}$  inch of lung shows through. There is, however no line of cleavage between this tough fibrous material and the lung itself. Evidently fibrous prolongations extend down into the lung tissue so that if we should try to peel it away there would be much bleeding and bubbling and considerable lung tissue would be torn off and would come away with the exudate therefore we will make three other incisions parallel to the first one, and five or six incisions across these as suggested by the late Dr. Joseph Ransoboff of Cincinnati. This is not a scancification but each

Incision penetrates through the entire thickness of the confining membrane and even a tiny bit into the lung so as to make sure that we gain all that is possible in expansibility.

Dr. Goldman will now apply air pressure through a nasal tube which extends into the pharynx, at the same time closing the opposite nostril with his finger and also closing the patient's lips. It is interesting and most gratifying to see now how the lung gradually becomes inflated so that finally all except the extreme lower part has completely filled the chest, and instead of a 500 c.c. cavity we have lung in contact with chest wall. I will dissect away here and there some of the little islands left by the cross-hatching incisions, using forceps and scissors. The patient's condition being excellent, I will try to dissect the lower lobe free from the diaphragm, and here we find a good line of cleavage so that the lower surface of the lobe is nicely freed. Even so however it does not quite bulge to the chest wall. I think that when blowing exercises are begun the patient will be able to fill his chest completely. I will place a little drainage-tube at the anterior part of the chest where we have resected a part of a rib and also posteriorly above. These tubes will be used for postoperative treatment by means of the Carrel method. We will now close this large wound. No great effort is made to bring the ribs together but the muscles are sutured with interrupted catgut stitches which narrows the widened intercostal space and also approximates the skin edges to within about  $\frac{1}{4}$  inch of each other. This narrow wound we pack with folded moistened gauze, and in three or four days the gauze will be removed and the wound closed with strips of adhesive plaster.

I told this boy's father that if all went well his son should be discharged in four weeks from the time of operation. I arrived at this conclusion from the treatment of many cases by this method. I began at Bellevue Hospital in 1916, and during the War at Base Hospitals Nos. 3 and 101 in France I had the opportunity to test the method out very thoroughly. I found that in most cases in which there was no complication healing was complete in about four weeks. Often the external wound closed soundly in the presence of a certain degree of pneumo-

thorax, which gradually became obliterated. So I felt safe in making my promise so far as a surgeon can promise anything. We will now dress the wound with plenty of gauze and hold it in place with adhesive strips, no bandage or strap encircling the body.

**Postoperative Notes.**—No shock followed this operation; the patient began his blowing exercises the same night. Three days



Fig. 67a.—C. McR. Wound completely healed. Note original small thoracotomy scar above anterior part of main scar.

later treatment by the Carrel Dakin method was begun. The upper tube was removed in three weeks and the lower one was left out on July 21st, about four weeks after the operation, five or six smears taken from the end of the tube from the inside of the chest cavity having shown that no discoverable organisms existed. I often make cultures from the tubes in these cases, but this cavity was not large, and I judged it would probably

take care of a few bacteria so long as no streptococci were present. On July 25th exactly one month from the time of the operation, the patient was discharged from the hospital with a tiny gra-



Fig. 679.—Same patient as Fig. 678, four months after operation, showing great improvement in the scoliotic deformity. Unfortunately there is no preoperative photograph.

ulating area still present. I kept him under observation for a few weeks and then sent him back to Jackson ville in splendid condition. A recent letter from his father states that the cure is apparently complete (Figs. 678-679).

## MULTIPLE RESECTION OF RIBS WITH COLLAPSE OF CHEST FOR PULMONARY TUBERCULOSIS

DR. LAWRENCE BROWN of Saranac Lake kindly referred this patient to me. She is Miss Marie F. twenty-four years old, who has been ill for some years with tuberculosis. I need not go into the details of her history but I will say that at present she weighs only 79½ pounds, that her general condition is extremely poor that there is cough with slight expectoration, and distress from shortness of breath etc. The x-ray examination made at the Trudeau Sanatorium showed the presence of well-marked tuberculosis in the right lung, with extensive disease of the left, in the upper part of which was a large cavity of the left lung irregular in shape (Fig. 680). Owing to adhesions and pleurisy Dr. Brown did not believe that artificial pneumothorax could be produced and advised surgical collapse of the left chest. When she entered this hospital (Flower) on July 18th I found her pale and slightly cyanotic with a weak pulse of about 130 and temperature of 101 F. The case did not look surgically promising to me, but neither was the outlook brilliant without the operation. I explained the matter very carefully to the patient's family and their decision was for operation. The patient herself readily consented, and here she is.

I intend to perform the operation as nearly as possible by the method used by Sauerbruch which appears to me to be as safe as any procedure in a disease of this kind can be. It does not expose the lung or open the pleural cavity and there is the further advantage that we can stop the operation at almost any stage completing it later.

Dr. Branower is administering the anesthetic—gas and ether—by the ordinary closed method without intrapharyngeal pressure and Dr. Harold Neuhof is assisting me. Doing work of this kind it is most important that the first assistant shall be himself a skilled surgeon because much depends upon speed

without haste. You will see that while I am operating Dr Neuhof is not only assisting but is operating also.

The patient being now under the anesthetic Dr Neuhof is injecting 15 c.c. of a 30 per cent. sodium citrate solution into



Fig. 630.—Preoperative x-ray in the case of Maria F. For advanced tuberculosis of left lung with large cavities at apex. Note also generalized lesions of right lung.

each buttock after a method devised by himself for lowering the coagulation time of the blood.

We will now turn the patient so that she is lying partly over on her face the plane of the back being at an angle of about 45 degrees with the horizontal, the chest and abdomen being

supported by sand-pillows. Our incision begins at the level of the second rib and follows the course of the spine about  $2\frac{1}{4}$  inches away from it downward to the eighth rib where it curves slightly forward. The left arm and shoulder are drawn forward so that the scapula is as far out of the way as possible. We

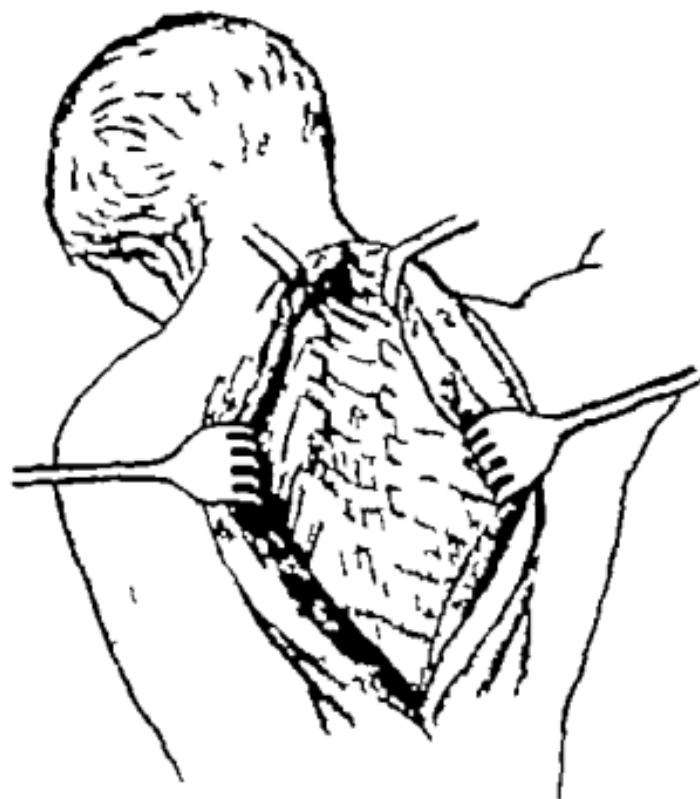


Fig. 681.—A drawing representing Saenger's multiple parapleural rib resection for collapse of the chest. The second, third, fourth, and fifth ribs have been resected. The first, sixth, seventh, and eighth are still to be resected. The posterior stumps are finally cut away to the spine itself.

quickly divide the muscles of the back, exposing the third, fourth, and fifth ribs. These are now resected subperiosteally removing from 1 to about 4 inches of each smaller amounts being taken from the upper ribs than from the lower ones. Now the second rib is divided and with great care having extended

the incision upward I am able to make a 1½-inch resection of the first rib also. Dr. Branower reports the patient's condition as excellent, so let us confine and resect the sixth, now the seventh,



Fig. 682.—Compare with Fig. 680. Same case three months after operation. Note great contraction of left chest and the bony bridges connecting the divided ribs.

and then the eighth. With the rongeur we will now remove all the remaining posterior parts of the resected ribs to the spine itself, except the first rib. You see this is not a difficult matter with the exposure afforded and with the pleura not opened, but

with the first rib this promises to prolong the operation, so we will rest satisfied with the 1 inch which was originally taken away. A long split rubber drain extending the entire length of the wound is put in place and then the divided muscles and fascia are brought together with sutures of chromicized catgut.



Fig. 683.—Photograph two and half months after thoracoplasty collapse of left chest for tuberculosis. Patient is greatly improved. Temperature normal. N sputum. Slight cough still present. Gauze of 11 pounds to eight.

This operation having been presumably clean I think we may take a chance on suturing the skin and for this we will use fine silk. The dressing of gauze is put in place and you will note that we are not using a bandage for fear of too greatly embarrassing the respiration but will hold the dressings in place with

the incision upward I am able to make a 1-inch resection of the first rib also. Dr. Branower reports the patient's condition as excellent, so let us continue and resect the sixth now the seventh,



Fig. 612.—Compare with Fig. 600. Same case three months after operation. Not great contraction of left chest and the skin bridge connecting the divided ribs.

and then the eighth. With the rongeur we will now close all the remaining posterior parts of the resected ribs to the spine itself, except the first rib. You see this is not a difficult matter with the exposure afforded and with the pleura not opened, but

## CLINIC OF DR. RICHARD LEWISOHN

AT SINAI HOSPITAL

### PENETRATING ULCERS OF THE LESSER CURVATURE OF THE STOMACH

*Etiology of Gastric Ulcers. Some Diagnostic Points of Interest. Discussion of Different Surgical Procedures. Report of Four Cases Cured by Partial Gastrectomy*

In the following presentation I will consider the subject of ulcers situated at or near the lesser curvature of the stomach between cardia and pylorus. I do not present for consideration those ulcers which are situated at the pylorus or in the duodenum.

Compared with pyloric and duodenal ulcers, which are very frequent, the ulcers of the lesser curvature of the stomach are comparatively rare. However they do not present a curiosity. In fact, their occurrence is sufficiently frequent to warrant a short discussion as to etiology, diagnosis, and treatment.

The etiology of these ulcers is as obscure as that of the pyloric and duodenal ulcers.

Rosenow (Production of Ulcer of the Stomach by Injection of Streptococci, Jour Amer Med Assoc, 1913 61 1947) demonstrated about five years ago the possibility of an infectious origin of gastric ulcers (streptococci).

Reeves (A Study of the Arteries Supplying the Stomach and Duodenum and Their Relation to Ulcer Surg Gyn and Obst., 1920 30 374) has published interesting anatomic studies, showing the close relation of ulcers to arterial vessels, which branch off from the main gastric arteries and pierce through the wall of the stomach. There are many other theories on the causation of gastric ulcers. Many authors in the recent literature assume a close relation between the endocrines and the

long adhesive plaster strips which do not completely encircle the body. We must not forget that the other lung is also seriously diseased.

**Postoperative Notes.**—Some shock followed the operation, but seven hours later Miss F had revived nicely and was in excellent spirits, complaining of no pain although the tight adhesive dressing annoyed her. Two days later the nurse reported that the patient had coughed and expectorated only once since the operation. Her temperature rose to 101.4° F and the pulse to 132. She was put on digitalis therapy as a prophylactic. Three days after operation I discovered that the entire wound was mildly infected so I thought it best to remove the sutures, and this promptly relieved absorption symptoms. The left chest was compressed by means of adhesive plaster strips each with an inset of strong rubber bandage.

A few days later I left New York for my vacation and Dr. Neubof took charge. The patient made a rapid surgical recovery and on my return to New York in September I found her condition excellent, the wound firmly closed, a gain of 7 pounds in weight, and scarcely any cough present. The temperature is normal.

The photograph (Fig. 683) and the reproductions of the x-ray pictures will give a good idea of the amount of compression secured, but it will be noted that the resected parts of the first and second ribs have been reproduced by new bone. Probably a resection of first and second ribs with the periosteum would in a measure have prevented this, although any resection short of 1½ inches even when the periosteum is also taken is apt to be followed by regeneration of bone.

**Note**—December 3d Miss F has returned to her home. There has been further gain in weight and she continues to improve.



Fig. 684.—Patient H. S. Roentgenogram showing penetrating ulcer of the lesser curvature of the stomach. This illustration should have been reversed, showing the stomach on the left side.

tical with those caused by pyloric ulcers. It is fairly easy in the majority of instances, to make a diagnosis of gastric ulcer from the clinical symptoms. However it is impossible to accurately

formation of ulcers. None of these different theories is definitely proved as the causative factor. None of them gives an explanation for the vast preponderance of the occurrence of gastric ulcers in male as compared to the female sex.

The existence of a large number of gastric ulcers in the male sex holds good for the penetrating ulcers of the lesser curvature as well as for the pyloric and duodenal ulcers. Of course exceptions make the rule. However generally speaking ulcer of the stomach is the most frequent upper abdominal disease in the male, cholelithiasis in the female.

The patient usually gives a history of epigastric distress, extending over many years. Marked periodicity of symptoms occurs in penetrating ulcers of the lesser curvature of the stomach as well as in pyloric or duodenal ulcers. These patients are often free from symptoms for periods of from six to nine months. They consider themselves cured until a sudden severe relapse demonstrates that their improvement was of temporary nature only.

The epigastric distress is often very severe. The pains are usually located under the xiphoid process, radiating to the left side. The patients often complain of pains in the precordial region. I have seen patients who were treated for heart disease for years yet the x ray proved conclusively that the so-called angina attacks were only referred pains and that they suffered from a penetrating ulcer of the lesser curvature. In another case appendectomy had been performed some years previously without relief of symptoms. Gastric resection cured this patient.

The pains usually occur a short time after eating, at a much shorter interval than in pyloric or duodenal ulcers. Sour eructations are very frequent, vomiting is comparatively rare. Occasionally we find occult blood in the stools as a symptom of an ulcerative process in the gastric mucosa. In other instances we encounter a profuse gastric hemorrhage as the first serious symptom, caused by erosion of a large blood-vessel in the bed of the ulcer-bearing area.

It is evident from this short description that the symptoms caused by penetrating ulcer of the stomach are practically iden-

the ulcer is situated on the posterior wall of the stomach and cannot be visualized in the picture. In other words, the size of



Fig. 684.—Same patient. Roentgenogram showing size of stomach one year after partial gastrectomy.

Handeck's niche and the size of the ulcer are not identical in many cases.

This point is shown very well if we compare Figs. 684-685.

diagnose the exact location of the lesion without the aid of roentgenoscopy or roentgenography.

The x-ray examination shows the typical excavation at the lesser curvature of the stomach (Fig. 684).

The x-ray diagnosis is pathognomonic for this disease as no other method of investigation can definitely settle the location of the ulcer. It must, however, be borne in mind that the demon-

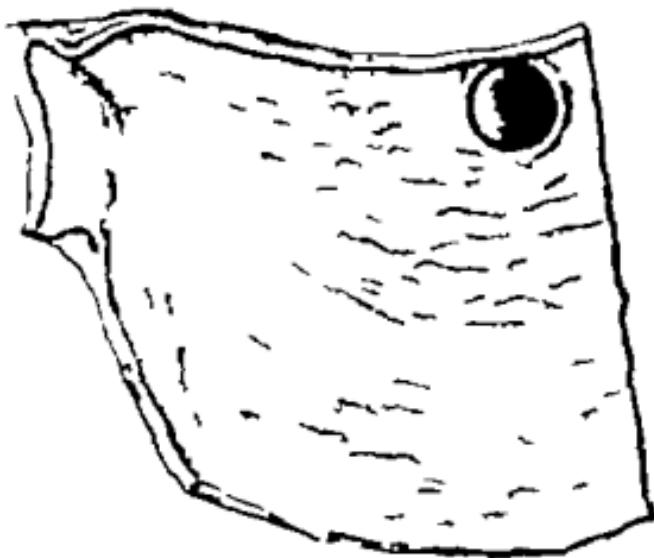


Fig. 685.—Same patient. Specimen of penetrating ulcer removed by partial gastrectomy.

stration of the excavation (so-called "Handeck's niche") does not exclude the possibility of a malignant growth.

The x-ray picture shows in many cases an hour-glass formation of the stomach. This hour-glass formation is often simple reflex in other cases it is formed by a large ulcer extending over the posterior wall of the stomach and thus causing a marked narrowing of the gastric lumen. In these cases only a small area of the ulcer is demonstrated on the x-ray picture—the largest part of

are not permanently cured. They usually develop an hour glass formation of their stomach a few months after the operation. For this reason sleeve resection ought to be definitely abandoned.

The same complication (hour-glass formation) follows simple excision of the ulcer no matter in what direction we apply the sutures in order to close the defect.

A method which is still very popular among surgeons is the local excision combined with gastro-enterostomy. This simple method, which I have used in 6 cases, has given good results. All these patients made uneventful operative recoveries. However their final results were not nearly as good as in those cases in which I performed a partial gastrectomy.

The best end-results are undoubtedly obtained by partial gastrectomy. However this method must be used only in those cases in which the ulcer is situated either near the pylorus or midway between pylorus and cardia at the so-called re-entrant angle. When the ulcer is situated at or near the cardia gastrectomy would represent too formidable a procedure. For these cases local excision (or Balfour's cautery excision) with or without subsequent gastro-enterostomy is the most advisable procedure.

It seems undoubtedly a rather formidable procedure to remove one-half or even two-thirds of the stomach though the size of the ulcer is often not larger than a dime. Yet experience has shown that end-results following partial gastrectomy are far superior to those obtained by other methods. My personal experience with partial gastrectomy for penetrating ulcers of the lesser curvature is limited to 4 cases. All these patients made an uneventful operative recovery and left the hospital two weeks after the operation. They are in excellent health now (2 patients were operated over a year ago the others are of more recent date). They are absolutely free from symptoms, though in 2 cases about two-thirds of the stomach was removed at the time of operation.

The great advantage of partial gastrectomy is based on two facts (1) It safeguards against hour-glass formation, and (2) it prevents formation of subsequent ulcers by the removal of

Figure 684 shows a comparatively small defect. Figure 685 shows the real size of this ulcer as demonstrated in the specimen (after partial gastrectomy).

The patient made an uneventful recovery (operation twelve months ago) and is completely relieved of his symptoms, though at least two-thirds of his stomach had been removed at operation (Fig. 686).

The x-ray examination further shows a marked six-hour residue in some instances. This residue is usually caused by pyloric reflex, not by a real obstruction at the pylorus.

The chemical investigation of the gastric contents plays a rather unimportant rôle as compared with the personal history of the patient and the x-ray findings. Marked hyperacidity may be considered as corroborative evidence. However the lack of reliability of the chemical data is best demonstrated by the fact that I have seen several cases of microscopically proved benign penetrating ulcers of the lesser curvature of the stomach with marked hypo-acidity and even complete anacidity.

The treatment of penetrating ulcers of the stomach is purely surgical. Medical treatment may alleviate the symptoms occasionally however but it can never cure these ulcers. Anybody who has seen a large number of these punched-out gastric defects will agree with me that no medicine or diet can have any marked influence on these ulcers.

The operative methods for the cure of penetrating ulcers of the lesser curvature have become more radical during the last few years. Formerly simple gastro-enterostomy was deemed sufficient to cure these ulcers. However it has been definitely proved that gastro-enterostomy will not cure ulcers of the lesser curvature. I have seen 2 cases in which the ulcers persisted in spite of a previous gastro-enterostomy performed in other hospitals. Both cases were cured, one by local excision, the other by partial gastrectomy.

Another procedure which formerly was employed in ulcers of the lesser curvature was the so-called sleeve resection. Though immediate results of this operation are very good, the patients

button as a guide the stomach can be drawn down easily and united with the jejunum without any tension.

Occasionally the button will stay in the stomach, thus requiring a secondary operation. With the use of the Weir modification of the Murphy button this is a rare occurrence.

Many surgeons use the Polya Balfour method in preference to gastro-jejunostomy. Haberer (Anwendungsbreite und Vorteile der Magenresection Billroth I, Arch. f. chir. 1920 114 127) has used the Billroth I method in a large number of cases.

Resection of the stomach in uncomplicated cases of penetrating ulcer of the stomach is undoubtedly a very simple procedure. However in complicated cases with extensive adhesions this operation can be very difficult.

In one case the ulcer occupied a large portion of the posterior wall and was so densely adherent to the pancreas that the base of the ulcer was left attached to the pancreas. In case of extensive adhesions on the posterior aspect the stomach is completely divided on the proximal side before the division of adhesions is attempted. The separation of adhesions can then be performed under the guidance of the eye—a much safer procedure.

This case—technically the most difficult of the four operations—had very large glands along the lesser curvature and in the transverse mesocolon which aroused a suspicion of the malignant nature of the ulcer. If it were a carcinoma this case would have been inoperable on account of extensive glandular involvement. However it was decided to give the patient the benefit of the doubt. Microscopic examination showed benign ulcer. The glands showed inflammation, but no malignancy. This patient feels perfectly well now one and a half years after the operation.

When patients have suffered from profuse hemorrhages they should be given the benefit of a preoperative transfusion of blood. Their chances for a smooth postoperative course are thus decidedly improved.

In rare instances we meet very large ulcers so densely adherent to the surrounding tissues that their radical removal is

the antral and pyloric portion of the stomach. Furthermore, this method seems to prevent formation of gastrojejunal ulcer, as gastrojejunal ulcers are very uncommon in cases where the antrum of the stomach and the pylorus have been removed.

The following operative procedure was employed. After ligation of the vessels the lesser omentum was entered and some slight adhesions between the posterior wall of the stomach and the pancreas were freed. The stomach was divided proximally to the ulcer on one side and just distally from the pylorus on the other side. It is very important, in order to secure a safe closure of the distal stump, to carry the resection beyond the pylorus. Gastric and duodenal stumps were closed with three layers of chromic catgut. Before closing the gastric end one-half of a Murphy button was dropped into the remnant of the stomach. The other part of the button was inserted into the jejunum in typical fashion. A very small stab was then made into the posterior wall of the stomach. The gastric half of the button was pushed through this opening and stomach and jejunum were thus united. The abdominal wall was closed in layers without drainage. The button was passed per rectum without causing any trouble in these 4 patients.

I would like to say a few words about the application of the Murphy button in gastric resection. The button was used extensively for many years. In fact, its construction by the late Dr. Murphy was one of the important factors in the development of modern gastric surgery. However there has been a tendency to discredit the use of the button during the past few years. A number of surgeons strongly advise against the use of it. According to them the button is of historic interest only.

It seems that such a radical point of view is not warranted by facts. The button still has its place in certain selected chapters of gastric surgery. There can be no doubt that by using the Murphy button instead of suture gastro-enterostomy we can increase our indications for resection of the stomach materially. It is very easy thus to re-establish the gastro-intestinal continuity even when a very small portion of the stomach is left after resection and suture. By using the gastric half of the

button as a guide the stomach can be drawn down easily and united with the jejunum without any tension.

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Many surgeons use the Polya Balfour method in preference to gastro-jejunostomy. Haberer (Anwendungsbreite und Vor teile der Magenresection Billroth I Arch. f. chir. 1920 114 127) has used the Billroth I method in a large number of cases.

Resection of the stomach in uncomplicated cases of penetrating ulcer of the stomach is undoubtedly a very simple procedure. However in complicated cases with extensive adhesions this operation can be very difficult.

In one case the ulcer occupied a large portion of the posterior wall and was so densely adherent to the pancreas that the base of the ulcer was left attached to the pancreas. In case of extensive adhesions on the posterior aspect the stomach is completely divided on the proximal side before the division of adhesions is attempted. The separation of adhesions can then be performed under the guidance of the eye—a much safer procedure.

This case—technically the most difficult of the four operations—had very large glands along the lesser curvature and in the transverse mesocolon which aroused a suspicion of the malignant nature of the ulcer. If it were a carcinoma this case would have been inoperable on account of extensive glandular involvement. However it was decided to give the patient the benefit of the doubt. Microscopic examination showed benign ulcer. The glands showed inflammation, but no malignancy. This patient feels perfectly well now one and a half years after the operation.

When patients have suffered from profuse hemorrhages they should be given the benefit of a preoperative transfusion of blood. Their chances for smooth postoperative course are thus decidedly improved.

In rare instances we meet very large ulcers so densely adherent to the surrounding tissues that their radical removal is

out of the question. In such cases jejunostomy may be performed with advantage. The complete side-tracking of the food for one to two months gives these ulcers a chance to heal. I have seen a case of perforated ulcer of the anterior wall of the stomach (with an abscess in the abdominal wall) which was cured by temporary jejunostomy.

The postoperative course following the resection of the stomach has to be watched with great care. It is advisable to give the patients a subcutaneous injection of saline solution immediately after the operation. This injection is repeated the same evening and possibly the following day. If the patients vomit a great deal or complain of epigastric distress a stomach-tube (without lavage) is passed the next day. This usually relieves the patient considerably. Water by mouth is given forty-eight hours after the operation, first in very small quantities.

From the third or fourth day fluids are given in larger amounts, to be followed by semisolid food by the end of the first week.

The after treatment is of the greatest importance. These patients have to keep a strict diet (with avoidance of fats and acids) for at least one year. In this way only can we obtain good end-results.

Rapid progress has been made in the last few years in the surgical treatment of penetrating ulcers of the lesser curvature. Experience shows that the radical removal of these ulcers is the proper procedure in the majority of cases and represents one of the most gratifying chapters in gastric surgery.

## CLINIC OF DR. JOHN J. MOORHEAD

From Division of Traumatic Surgery Post-Graduate Hospital

### "TRAUMATIC" (?) INGUINAL HERNIA

PATIENT is thirty two years old, mechanic, born in United States weight now 160 pounds height 5 feet, 9 inches

Chief Complaint.—Lump in right groin. Duration seven weeks.

Family and past histories are unimportant.

Present History.—Seven weeks ago while at work he lifted a heavy piece of metal and felt that he had strained himself in the lower part of his abdomen. No severe pain. No nausea. Continued at work. That night noticed a lump in his right groin the size of a marble. This disappeared during the night, but reappeared during the day and grew larger during the following weeks. It causes no pain. It disappears when he lies down or when he presses upon it. Coughing straining or lifting causes the lump to increase in size.

Examination shows an egg-sized swelling in the right inguinal region close to the external abdominal ring. Direct pressure causes the lump to disappear. It does not reappear when he strains if the external ring is pressed upon through the abdominal wall or by invaginating the scrotum. The lax external ring admits the thumb. There is no protrusion along the opposite inguinal canal or in the femoral or umbilical regions. No varicocele. No hemorrhoids. General examination otherwise normal.

Diagnosis.—Indirect inguinal hernia, third degree or + + +

Remarks.—The external ring is normally large enough to admit the tip of the little finger and on straining no impulse is apparent. For purposes of classification we can say that there

are *four degrees* of inguinal hernia and "hernia" is, in reality only another name for *ptosis*.

First degree hernia means that the ring is dilated enough to admit the index-finger tip and an impulse is present. This is designated +

Second degree hernia means that the ring is still further dilated impulse is present, and a palpable mass appears at the ring. This is designated ++

Third degree hernia means that all the elements exist as in the second degree, and in addition, there is a visible mass at either ring or along the canal. This is designated + + +

Fourth degree hernia means that the mass enters the scrotum. This is designated + + + +

In the advanced degrees the size of the mass may be designated by comparison with any chosen globular object, for example, a walnut, egg etc.

Given, then, some standard as to the degree of any hernia, what is to be said as to the relation of a given injury to the production of the hernia. There are three main phases to this inquiry namely

- (1) Is there any such thing as 'traumatic hernia', one arising solely from a single act of violence?
- (2) If not, how does a single act of violence affect the development of hernia?
- (3) And again, what is the effect of repeated acts of violence in the production of a hernia?

Before answering any of these questions let us revert to the anatomy of the matter in terms of simple analogy. The inguinal canal with a hole at either end (which we call 'internal ring' and 'external ring') can be compared to the parturient cervical canal which also has a hole at either end (which we call the "internal os" and the "external os"). Both canals have normally a fixed caliber adequate to their respective physiologic demands. Under the stress of continuing intra-abdominal pressure both canals dilate until each gives birth to something which in one case may be a fetus, in the other a coil of intestine or omentum. In both cases the dilatation of the canal was slow

in onset, progressive impelled by the *vis-a-tergo* the push from behind due to repeated or intermittent intra-abdominal pressure. Alike also is the appearance of the "mass" at the outlet. In the one case the final intra-abdominal contraction produces the fetus in the other case the intestine or omentum. A *single* intra-abdominal contraction never causes a dilation of the cervical canal or of the inguinal canal the process in both cases is slow the product of a continuing oft repeated force. External violence causes dilatation of the cervical canal only in proportion to the amount of productive intra-abdominal pressure. The same thing applies to the inguinal canal. External violence has caused the birth of a child by virtually performing a cesarean section with accompanying laceration of the uterine or abdominal wall. The same thing has occurred when some act of violence has penetrated the inguinal canal from without, as, for example, the museum cases in which the patient has been impaled on a picket or the horns of an animal. But these things are exceptionally rare, and clinically they are not seen at the bedside or in the operating room.

We are not concerned with these cases of what may be termed compound herma, in which there has been a severing of muscles and fascial planes these are the rare events read of in the library but not seen in practice.

To revert, then, to *question one*. Can a single act of violence cause a hernia The answer is "no" unless the violence has caused a severing of the overlying muscular and fascial protectives.

*Question two*. What is the effect of a single act of violence in the development of herma? The answer is that it depends on the individual and upon the type and place of receipt of the violence. An individual of the ptosis type is in a receptive state, his muscles are lax, his rings are open, they probably are dilated by vasoconstrictions acting virtually as a Barnes bag and he doubtless has had a first degree hernia for years and, indeed, he was probably born with a patent internal ring. This type of individual sooner or later will develop a hernia one final act of violence associated with intra-abdominal strain may give birth

to his hernia, which for years had been in a nascent state—he had to carry out the analogy almost arrived at "full term. Sneezing coughing straining of many sorts would carry him from the first degree of hernia into an advanced degree, and he doubtless would show bilateral hernia on closer examination.

The hardy individual would not be affected at all by a single or isolated act of violence which in the ptotic type of individual caused the protrusion to appear or increase.

Hence the physique is important. Now the type of violence and the place of its receipt are also important. The essential element in the relationship of violence is, did it cause intra-abdominal pressure. If so it may be a factor if of a grade sufficient to cause sudden widening of a ring or the canal if so, *immediate symptoms* would appear and these would be pain, nausea, tenderness, and later a mass and probably some discoloration. If there is no immediate onset, then the relationship is as doubtful as in an alleged case of concussion from a blow on the head in which there was no immediate unconsciousness. The point is that we cannot traumatize a piece of intestine or omentum without appropriate manifestations try it in operating on a patient under local anesthesia and note what happens. It is absurd to believe that a piece of intestine or omentum can be forcibly crowded into a normal ring or canal without the patient's knowing about it until hours, days, or weeks later. Yet that is the history we get in the majority of cases.

A fall on the feet a blow on the back or chest, some *indirect* transmission of the violence to the abdomen or inguinal region is never an incident of much causal relationship. Lifting, pushing, pulling—all these may narrow the abdomen, may produce intra-abdominal pressure enough to play some part in the production of the hernia if the element of adequacy permits adequacy of violence, adequacy of the immediate symptoms.

*Question three.* What is the effect of repeated acts of violence in the production of hernia?

Here again, it depends on the individual physique and the type of the violence. Repetition of the intra-abdominal strain

is the greatest factor in the production of hernia. If for any reason, the individual is of the ptotic or hernia type, then repeated intra-abdominal strain may be the causative factor in the production or aggravation of his hernia. Weight-lifters, wrestlers, and others of that type do not fall into the hernia class because they have a symmetric muscular development. Likewise, workmen who use their muscles after the manner of athletes do not become herniated but any group of men who use one set of muscles without commensurate development of others may become herniated. Asymmetry of development is, then, an element of importance.

We may interject here the statement that no adult has ever been spontaneously cured of a hernia spontaneous cure may occur up to the tenth year but after that period cure is by a process of cutting and sewing.

We may also say that repeated or intermittent intra-abdominal strain is capable of aggravating a hernia once formed but we hasten to add that every hernia habitually and of itself increases in size. So when we are called upon to render an opinion as to the relation of injury to the onset or progress of an inguinal hernia we must also bear in mind certain clinical facts of every-day experience of these, the following may add to what has already been said.

(A) A large proportion of adults have hernia and know nothing about it. In the draft age alone, witness the number of substandard candidates. If our young men were herniated by the thousands, what of our men over thirty years of age?

(B) A fully developed hernia on one side and a partly developed hernia on the other side is more an anatomic defect than a traumatic effect.

(C) There is a family history in hernia that is often very surprising it points to some transmitted strain of muscular deficiency as typical as a facial feature or birthmark.

(D) We have fractures of the pelvis, of the thighs, and all sorts of injuries in the inguinal region, but who ever saw or recorded a case in which a hernia was an accompaniment?

To sum up

(1) No single or isolated act of violence causes hernia unless the overlying parts have been lacerated.

(2) No single act of violence aggravates a hernia unless the violence produced intra-abdominal pressure and immediate onset of symptoms.

(3) Repeated acts of violence capable of causing intra-abdominal pressure can produce a hernia and can act as an aggravating cause if the violence and the symptoms are adequate.

(4) External violence is only one of many factors in activating intra-abdominal pressure which is the essential causative element.

(5) Repeated "strain" of many sorts may be as contributory as some alleged traumatic strain. Of these intrinsic causes may be mentioned coughing, sneezing, straining at stool or in urinating, and pulling and pushing motions incidental to athletics or some form of sport.

The Hernia Operation. Bassini Modified Technic Followed.

—*Steps.* (1) Incision from spine of pubis upward and outward 4 inches, a little vertical to Poupart's ligament. Deepen this until the shining strands of the external oblique fascia are seen the latter is just below the areolar tissue layer.

(2) (a) Expose the external ring and contents.

(b) Expose a white band at the outer side of the fascia this is the external aspect of the "shelving edge" of Poupart's ligament (i.e. the latter is the twisted part of the external oblique fascia)

(3) Expose the canal by slitting the external oblique fascia and dissect it freely especially the outer part, so that the inner side of "shelving edge" shows plainly.

(4) Lift up contents of canal by placing tip of index-finger around cord at pubic spine. Recognize vas by sight and by touch. It is as hard as metal and does not compress like a vein.

(5) Recognize sac at external ring end and separate it from adjacent elements of cord.

(6) Bring neck of sac clearly into view by dissection and traction.

(7) Open sac and recognize the interior of it by the resem-

blance to the inside of a morning glory: this is a good test as between a real and a false sac.

(8) Transfix sac and cut off excess. Leave ligature long and drop sac stump and then pull it into view again: this tests the hold of the ligature and the hemostats.

(9) Keep cord out of the field by passing an artery clamp under it, catching the lower margin of the external oblique fascia in two places: this will hang the cord over the outer edge of the field.

(10) With chromic or kangaroo tendon gut narrow the internal ring with a stitch joining the internal oblique and the "shelving edge." Leave just room enough for the cord to snugly fit. Cut this ligature long and clamp it by pulling on this: the next suture can be readily passed through the same structures  $\frac{1}{2}$  inch further along. Each succeeding interrupted suture is clamped in turn. Narrow the external ring in the same close-up manner as the internal ring.

(11) Drop the cord into place. With continuous chromic or kangaroo tendon gut, suture the fascia.

(12) With plain gut, continuously suture the deep layers of the superficial fascia.

(13) Close skin and superficial fascia.

(14) Evert margin of wound and forcibly eject any blood so that the wound layers will be dry.

(15) Make a ridge of gauze along wound and then place on this the usual compresses and adhesive.

*Postoperative Course*—(1) Suspensory or adhesive bridge over thighs to support scrotum.

(2) Morphin per hypo (gr  $\frac{1}{2}$  followed by gr  $\frac{1}{2}$ ) for severe pain only.

(3) Catheterize for first twenty-four hours, p. r. n. Thereafter do not catheterize, but allow patient to get out of bed, bend forward and thus spontaneously void.

*Note*—This is done in preference to inducing a cystitis which may develop from the trauma of aseptic catheterization. It does not strain the wound if the patient relaxes by bending forward.

- (4) Stitches out on tenth day
- (5) Out of bed on the twelfth day
- (6) Out of hospital on the fourteenth day
- (7) To work on the twenty-eighth day if the parts are firm.

Patient cautioned against intra-abdominal strain for six weeks. No bandage or other support to be used.

*Comment*—Success in obtaining a cure depends primarily on the following factors:

- (1) Ability to obtain a high tie-off and narrowing of the neck of the sac. If this is attained, the pre-existing diverticulum of the peritoneum is definitely abolished.
- (2) Ability to firmly coapt muscle (internal oblique and conjoined) to the 'shelving edge'. If this is attained an effective barrier is built up against further intra-abdominal strain and subsequent direct hernia.
- (3) Ability to lengthen the distance between the rings by transplantation of the cord. If this is attained, any hernia seeking escape at the rings will find the exits blocked by a layer of muscle and fascia instead of by tissues far less resistant.
- (4) Ability to obtain primary union. If this is attained, all newly joined barriers offer lasting stability.

*Recurrence*—Statistics vary as to the success of operation but the rate usually quoted varies between 2 and 5 per cent. All surgeons know that a recurrence rate in direct hernia is about twice that of oblique hernia. Equally well known is the fact that in persons over forty-five the rate of recurrence varies from that in persons under forty-five. In working people the rate is greater than in the non-working class. In the fat, the thin, the enteropt tic, the diseased, the arteriosclerotic the rate varies in hernia end-results just as it varies in many other surgical end-results.

Our own rate of recurrence in working males is between 5 and 10 per cent. in the non-workers the rate is less than half of this. Hence the clinical fact is that (a) the physique, (b) the type of the hernia (direct or indirect) and (c) the occupation determine the end-results quite as much as the (d) operation elements named above.

## TRAUMATIC SPONDYLITIS (KUMMEL'S DISEASE)

S. G., aged twenty nine a telephone lineman by occupation.

Past History.—Negative for syphilis or tuberculosis.

Present History.—Seven months ago he fell from a tree a distance of about twenty five feet, and landed on his back. Unconscious for several moments. Did not vomit. Could not use right lower extremity nor when pins were stuck in it had he any sensation. Bladder overflowed spontaneously. Had no knowledge as to action of bowels.

After nine weeks the lost sensation and motion of right lower limb disappeared. Bowel function restored. Urinary control still involuntary so that dribbling is marked enough to keep clothing soiled. When he got out of bed at the end of about ten weeks he noticed that his back was arched forward and that there was a lump on it. The arching and the lump have slowly increased. Treatment at first was rest in bed and later massage was given. Previous x-ray examination is said to have disclosed no fracture of the spine.

Patient now complains of

(1) Inability to walk erect, (2) pain radiating from the back around the abdomen and along the groin more marked on the right side (3) inability to control urine (4) limitation of motion in the right lower limb

Examination shows good general physique.

Back.—Kypbos over the second lumbar region. Slight scoliosis. Marked forward arching of the spine. All spinous processes can be located.

Limbs.—No motor or sensory paralysis. Limitation of right hip motion in full extension and abduction.

Reflexes.—No gross changes. Clothing soiled by involuntary urination.

Gait.—Limited. Walks bent forward and to the right.

Diagnosis.—Fracture of lumbar spine—traumatic spondylitis.

**X-Ray Diagnosis.**—Fracture of lumbar spine with marked thinning of anterior portion of vertebral body

**Treatment.**—Plaster-of-Paris jacket with spine previously straightened as far as possible. Immediate relief considerable.

**Comment.**—Here is a patient who originally had a combined intra- and extraspinal lesion, the former probably a contusion of



Fig. 687.—Traumatic spondylosis, showing typical V-shaped deformity of vertebral bodies. It is typical

the cord with hemorrhage, the latter a fracture of the body or bodies of the vertebrae. In other words, this is a case of fracture of the spine with hematoxyelia in which the end-result is deformation of the bony column and some paralysis of the bladder.

We have had 4 cases of this sort recently all of them involving the dorsolumbar region.

The outstanding features in all the cases have been

- (1) History of an injury to the back without early gross evidence of spinal column damage
- (2) Intra-spinal symptoms varying from root pains to paraparesis (motor sensory trophic, or visceral)
- (3) Persistent localized pain over the affected vertebrae and limited motion of the spinal column with gait defects.
- (4) Gradual appearance of a hump in the painful area of the spine.
- (5) Increasing difficulty in arching of the back.
- (6) x Ray appearance of the vertebra, so that the normal U shape of the body is converted into a V shape the thin edge forward.
- (7) Motor sensory trophic, or visceral impairment of varied extent.

**Diagnosis.**—Given a history of definite injury to the spinal column capable of producing a fracture of the spine, with or without appropriate cord symptoms, and the presence of localized tenderness of the column and the subsequent development of kyphosis, the diagnosis should be entertained of fracture of the spine affecting primarily the anterior portion of the column, even though the original x ray examination fails to disclose definite bony damage. Differential diagnosis is to be made between hematoxylysis, contusion of the spine, traumatic lumbago, sacro-iliac sprain, or damage to the intra-spinal ligaments.

Military experience has shown several cases of so-called traumatic bent back, which goes by the name of "camptocormia," which has the forward arching of the column, the bent back, and the root pains seen in traumatic spondylitis. There are however no bony changes on physical or x-ray examination.

Traumatic spondylitis with V-shaped deformation of the affected body of the vertebra is to trauma what the similar deformation is to tubercular spondylitis (Pott's disease) and the x-ray findings are strikingly similar in each, inasmuch as the vertebral bodies undergo a similar grade of rarefaction.



Fig. 633.—Fracture-dislocation of hamer spine with subsequent apertural deformity. Note compression of anterior portion of ventrum.

Treatment.—In a suspected case of injury to the vertebral body immobilization should be provided from the outset, and this is best attained by a spinal jacket as nearly all of the reported cases affect the dorsolumbar region.



Fig. 689.—Traumatic spondylitis following fracture of body of vert. bra. See x-ray plate in Fig. 687. Note kyphos at arrows.

In a doubtful case a spinal brace or plaster-of-Paris jacket should be applied with the spine in a corrected position to remedy so far as possible the kyphosis and the associated scoliosis.

If despite the wearing of some such support the angulation still persists, it then becomes necessary to fix the spinal column by a bone-graft after the manner devised by Albee or Hibbs.

Scherb (Schweizer Medizin. Woch. Basel, August 18 1921  
vol. —100

51 No. 33) has described a modification of this spinal fixation graft by which the graft is laid alongside of the spinous process and held in place by tendon sutures.

Kleinberg, of New York City has told me that he has successfully used this procedure for tuberculous spondylitis, employing beef bone-grafts instead of autogenous grafts.

The writer intends to attempt this operation in 1 of the 4 cases of traumatic spondylitis recently under his care.

## MULTIPLE FRACTURES OF THE LEFT UPPER EXTREMITIES AND SHOULDER GIRDLE

T O aged thirty two a police sergeant.

History—November 8th, while on a rapidly moving motor cycle, he crashed into a lamp-post in Central Park and was rendered temporarily unconscious. Bone is said to have been found sticking out of a laceration in the left armpit. First aid was rendered at another hospital for this wound, a scalp wound and a fracture of the left humerus in two levels.

Operation at the Post-graduate Hospital four hours after injury

Findings—Procedure.—Lacerated wound 2 inches long in the left frontal region previously sutured re-iodinized and a sterilized small rubber drain inserted. There was a comminuted fracture of the left humerus in the area indicated by the accompanying x-ray prints also a fracture of the left radius at the upper third. There was a fracture of the left scapula spreading through the glenoid fossa, splitting the spinous process and the body of this bone. There was a gaping 2-inch wound in the left axillary fold. The margins of this were excised together with the frayed fascia beneath and the cavity was found to enter the axillary space and spread along the pectoral fold. All devitalized tissue and blood-clot were removed, following the war technic first advocated by the French (who used for this technic the terms *débridement* *épluchage* *hémorragie* meaning by these that all devitalized tissue was removed by knife or scissors). Hence the frayed edges were smoothly clipped off and the wound left relatively dry. Tincture of iodin was swabbed freely about the cavity interrupted stitches of silkwoom-gut closed the wound and a small rubber tube was inserted into its depth. Wet dressing of iodin-water (tincture of iodin 1 dram and saline solution 1 pint) was placed over the wound. Traction was then made upon the abducted arm with the elbow at a right angle and a plaster-of Paris spica

was applied reaching from the nipple line up to the neck, across the shoulder and thence down the arm and forearm to the wrist, the elbow being held at a right angle and the forearm in semi-supination—the abduction spica dressing.

Comment.—Tetanus antitoxin was administered prior to the operation because of the chances of soil infection, and this is a



Fig. 690.—Compound fracture of upper third of humerus before reduction.



Fig. 691.—Fracture lines in humerus after reduction.

precaution that should not be neglected in any compound fracture, or indeed in any wound in which manured soil has an opportunity for contact. All fractures of the humerus in which there is displacement of the fragments lend themselves to two methods of treatment after the fragments have been coapted by



Fig. 692.—Fracture of lower third of humerus and middle third of radius.  
Abduction molded splint applied.



Fig. 693.—Fracture lines in scapula radiating from glenoid into body and spineous process.

traction or manipulation. The fractures of the *lower* fourth of the humerus, namely those involving the supracondylar and condylar region are to be placed in a position of hyperflexion

(Jones' position) and the forearm is to be in a position of marked abduction so that the normal carrying angle will be maintained. Fractures of the upper three-quarters of the bone are best treated in a position of abduction of the arm to a right angle with the forearm canted in a position of semisupination forward



Fig. 694.—Abduction plaster-of-Pars spica for multiple fractures of upper extremity.

of the axillary line, the elbow bent at a right angle and held by a plaster-of-Pars spica, thus attaining the aeroplane position.

This patient had practically no postoperative reaction, and the drain was removed on the third day by cutting a window in the cast over the site of the wound. The patient was then allowed out of bed in a chair.

The accompanying x-ray prints show the success of the reduction. The cast will be slit along the top of the extremity in about six weeks, and the cast will be removed and the arm brought to the side if union is firm; otherwise the same cast will be resupplied.

**Outlook.**—The general alignment is excellent and bony union should be attained in the humerus unless the small fragments noted act as foreign bodies in effect blocking the passage of bone-cells between the ends. In this event no union will occur. Coaptation of the radius seems sufficiently good to attain union. Non-union in fractures is most likely in the lower third of the tibia, and in the experience of the writer more cases of non-union occur in this location than in all the other parts of the skeleton combined. Non-union is next commonest in the radius then ulna, then humerus and then femur. The writer has never seen a case of non-union in the fibula even when the fragments have been much malaligned. There is practically no such thing as non-union in joint fractures except in fractures of the neck of the femur.

The commonest cause of non-union is non-reduction, the next commonest is non-retention either by too tight or too loose splintage. Interposition of soft parts (fascia, muscle, penosteum) or hard parts (bone, cartilage, or foreign bodies) are the next commonest causes of non-union. Systemic diseases are rare causes, notably syphilis. Calcium deficiency is a not uncommon cause. The use of plates, screws, wire, or any other form of non-absorbable material invites non-union, and virtually introduces into the tissue a foreign body which is not well tolerated. The writer is of the opinion that plating and allied methods in fracture work is being rapidly abandoned, just as the use of metallic sutures has long ago been abandoned for coaptation of the soft parts.



## REVISION OF LAMINECTOMY FOR FRACTURED SPINE

History.—M. G. H., aged thirty-seven, manager of electric company December 1, 1918 was struck on the back by a heavy valve stem which resulted in a fracture of the twelfth dorsal vertebra and a puncture of the left lung. There was immediate motor and sensory paralysis from the waist down, including loss of bladder and bowel control.

Operation the same night, when splintered bone and clothing are said to have been removed from the spinal canal. Five weeks later paralysis had descended to the level of the iliac crests. Spasticity of the legs after two months. Good union of the primary wound. Paralysis continued unchanged until the time of the second operation—March 1, 1920.

Laminection was then performed in the dorsolumbar region with removal of the scar tissue. After this operation sensation was present in thighs, and there was less rigidity of the limbs but this gain disappeared after a few months.

Since then he has been at home and there rigged up for himself an overhead trolley arrangement with ropes by which he could get about his room.

Bowels moved daily by large enemas, and he constantly wore a urinal.

He entered the Post-graduate Hospital eight weeks ago and at that time his general physique was excellent. There were no bed-sores, and the only obvious injury to the spinal column was at the site of the operative scar where three of the spinous processes were lacking (twelfth dorsal, first and second lumbar). There was complete motor and sensory paralysis from the level of the anterior-superior spine downward. Both lower extremities were rigidly spastic. All reflexes were abnormal. Bowel and bladder control were as described.

Under active massage and forced movements of both limbs the spasticity lessened. He was up and about daily in an

invalid walker. Large enemas on alternate days for the bowel condition, and the urinal was worn constantly.

x Ray examination showed the absence of that portion of the spinal column already described. There was no gross angulation of the spinal column, nor were the bodies of the vertebrae unduly compressed.

Comment.—Here is a case of massive injury to the spinal cord with abolition of all function from the level of the injury downward. Primary operation evidently removed spicule of bone only and a second operation evidently freed the cord, at least the posterior portion as indicated by the return of sensation. His condition has been unimproved for about a year and a half, and operation was decided upon in the hope that one of the following remediable conditions might be found:

- (1) Angulation of the cord by bone or scar.
- (2) Localized serous collection, the so-called posttraumatic spinal cyst named by the late Munro "localized serous meningitis."
- (3) Intradural or extradural adhesions, or both.

Finally it was recognized that under existing conditions further progress could not be obtained after this lapse of time. This situation was explained to the patient and family and, while the outlook was not good, the operation was assented to.

Operation (November 10, 1921)—Steps—(1) Curved incision to the right of the original incision, extending from the eighth dorsal to the second lumbar level.

(2) Scar tissue incised and retracted. Sharp hemorrhage controlled by packing and wide retraction by rib-spreaders.

(3) Cord was exposed for distance of 4 inches by removal of a portion of the remaining arches. Dural membranes found much thickened and tightly adherent laterally and anteriorly.

(4) Extradural adhesions separated by sharp dissection.

(5) Dura split, followed by an immediate gush of somewhat turbid, then by clear cerebrospinal fluid under pressure. No severance of the cord apparent. Probe readily passed up and down the canal for a distance of 2 inches each way.

(6) Dura sutured so that cerebrospinal fluid escape almost

stopped. Erector spine and scar tissue firmly closed by interrupted chromic gut sutures.

- (7) Deep fascia closed by running lock-stitch chromic gut.
- (8) Silk-worm-gut interrupted stitches for skin and fascia
- (9) Wound squeezed dry
- (10) Heavy dressing of gauze moistened with iodin water  
(1 dram of tincture of iodin to 1 pint of saline solution)
- (11) Heavy strapping of adhesive plaster

*Postoperative Orders*—(1) Morphin ( $\frac{1}{2}$  gr) followed by morphin ( $\frac{1}{2}$  gr) hypodermically for severe pain.

(2) Dorsal position. Head of bed elevated

*Summary of Operative Findings*—(1) Extradural and intradural adhesions.

(2) Narrowing of the canal by bony re-formation or non-removal.

*Outlook*—Barring ordinary postoperative complications, such as pneumonia and that form of sudden collapse incident to spinal cord operation there should be an immediate postoperative recovery with primary union. Ultimate gain will probably take the form of sensory return to some extent with little prospect of motor or visceral return. In other words, the relief from his present condition of paraplegia is very doubtful.

Spinal cord regeneration following actual damage to the cord structure is rare, and there are only a few cases on record where functional restoration has been obtained in the presence of structural damage. The spinal cord structures have no powers of regeneration, and military experience has proved over and over again the truth of this long-established clinical fact.

It is equally well known, however, that in the absence of operation the outlook is hopeless nevertheless, in a case of this gravity and long duration, operation offers the only possible chance for relief from prolonged invalidism.

The one outstanding case in the author's experience of recovery following definite structural damage is recorded in the writer's Traumatic Surgery 2d ed pp 602-603 in a young girl under the care of Dr Irving S Haynes and the writer. This patient is now able to earn her living and some slight

gait defect is the only remnant of her bullet wound penetrating the cord and liver.

*Note.*—December 6th Patient apparently much improved. Spasticity decreased joint freedom more marked. Is able to correctly interpret when deep pressure is made on legs. Wound healed kindly. Being fitted for double walking calipers.

## KNEE JOINT INJURIES

TRAUMA to joints usually expresses itself in terms of contusions, sprains, ligamentous tears, bursitis, synovitis, tenosynovitis, arthritis, dislocations, fractures. In abridged form we can say that joint injury may be intra-articular or extra-articular and may involve the soft part or the bony structure of any given articulation. In the knee joint we have the complexities inherent to a double joint, the pathology that may appear from damage to such structures as the semilunar cartilages, their contiguous cruciate ligaments and the tibial spine. The generous synovial membrane with many pouches, the numerous bursae, also contribute to make this joint the site of every manifestation to which articular pathology has given a nomenclature. There is no other joint of similar architecture none in which diagnostic skill is more severely put to test, none in which adequate treatment is more important.

Frequency.—Wounds excepted, contusions or contusion-sprains are the commonest injuries next, synovitis, bursitis. As antecedents, associates, complications or sequelae, loose bodies or cruciate ligament tears are next in frequency still later are such bony injuries as fracture of the patella, the margins of the femur or tibia. Least frequent are fractures of the tibial spine and uncomplicated dislocations of this joint.

Except for incidental remark no discussion is here intended for knee lesions other than synovitis, loose bodies, semilunar, cruciate ligament, and tibial spine affections. These are very closely interrelated as to causation and effect, inasmuch as all of the so-called "internal derangements" of the knee are aligned with synovitis. Indeed, many loose bodies originate from synovial trauma.

Structure.—The articulation between the femur and tibia needs no special description except to say that the inner margin of each bone because of prominence and contour is predisposed

to damage this is accentuated because the vertical axis of the thigh to the leg is one of abduction at an angle of 165 degrees, and the preservation of this makes greater demand on the inner than on the outer side of the joint. There are twelve bursa connected with this articulation three in front, four on the outer side five on the inner. Of these, the prepatellar bursa attracts most attention surgically.

There are three main *synovial pouches* or sacs, all inter-communicating when the joint is distended. Of these the largest is the *superior* or *suprapatella* which is on the femur above the patella. The second is the *central* or *middle* pouch which has for its boundaries the patella above and the mucous and alar ligaments below all tending to form a diaphragm from the front to the back of the joint. The third is the *posterior* or *inferior* which lies behind the preceding diaphragm and between it and the posterior ligament of the knee-joint. This last pouch or cavity is most important in septic conditions because it acts as a reservoir for pus and cannot be emptied by aspiration. When this sac is involved, the best clinical sign is fulness of the popliteal space and from it fluid may impidiously gravitate along the posterior surface of the limb until released by incision directly into or below the popliteal space.

With the five sets of so-called "exterior ligaments" and the seven sets of so-called "interior ligaments" we are interested chiefly by the latter consisting of the crucials the semilunar fibrocartilages the mucous the alar the transverse and the coronary ligaments are appendages respectively of the main synovial cavity and of the capsular ligament.

*Crucial ligaments* are so-called because they cross or decuminate V-like en route from the tibial head to the femoral condyles.

The *anterior* or *internal crucial* is surgically the most important, and is attached to the depression in front of the tibial spine and the front end of the external semilunar and thence it passes to the  back part of the outer condyle of the femur.

The  
more

*crucial* is the stronger shorter and to the depression behind the spine

of the tibia to the popliteal notch, and to the posterior end of the external semilunar thence it passes to the front part of the inner condyle of the femur. In passing it sends a fascial band to the posterior part of the anterior crucial.

This architectural arrangement readily gives the posterior crucial many advantages, which being interpreted clinically means that it is rarely injured except when its companion has first been damaged.

The chief function of the crucial ligaments is to keep the tibia from sliding too far forward or backward on the femur the anterior crucials prevent the tibia from being carried too far forward by the extensor muscles and the posterior crucials exert a restraining influence on the flexor muscles in carrying the tibia backward. They also aid the lateral ligaments in preventing undue side-to-side motion.

In full knee flexion the posterior crucials are taut and so is the ligamentum patellae all the others are relaxed by this motion, the anterior crucials only to a slight extent, however.

In full knee extension the ligamentum patellae is relaxed all the others are on stretch except the posterior crucial, which is partly relaxed.

In a position of semiflexion, rotatory motion is permitted by partial relaxation of the crucial and lateral ligaments.

Inward rotation is limited by tension of the anterior crucials and by the interlocking of both crucials.

Outward rotation is limited mainly by the internal lateral ligaments the crucials unlock and relax in this movement.

All this is usually summed up by saying that the anterior crucials are taut in extension and the posterior crucials are taut in flexion. Some believe that they are each taut in full flexion and extension and both lax in semiflexion.

The *semilunar fibrocartilages* are the intervertebral disks of the knee-joint, shock-absorbers, serving also to deepen the pockets on top of the tibia so that about two-thirds of the surface into which the femoral condyles socket has this sort of 'bushing' which is synovia covered.

The *internal semilunar* is almost semicircular and is at

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The *anterior* or *external* *crucial* is surgically the most important, and is attached to the depression in front of the tibial spine and the front end of the external semilunar and thence it passes to the inner and back part of the outer condyle of the femur.

The *posterior* or *internal* *crucial* is the stronger shorter and more vertical and is attached to the depression behind the spine

Synovitis arising from trauma, infection, or disease is chiefly characterized by a swollen knee in which lateral motion is increased. In traumatic cases we frequently have a history indicating preceding attacks in such instances and in those in which direct violence can be excluded we must be prepared to rule out loose bodies as the real causative factor. Careful examination may give palpatory evidences of such an offender.



Fig. 695.—Normal knee joint.



Fig. 696.—Normal knee joint.

If not injection of the joint with oxygen may serve to make known what an ordinary x-ray plate would fail to detect.

Oxygen injection of the joint is best performed by introducing the needle just outside the external margin of the patella just above the middle of this bone so that the point of the needle passes beneath the outer margin of the patella somewhat downward and inward. We must remember that with the knee in extension the joint level is lower than the tip of the patella.

tached in front by a thin pointed margin to a depression on the head of the tibia just in front of the anterior crucial ligament; and behind to a depression back of the tibial spine between the attachment of the external semilunar and the posterior crucial ligaments.

The *external semilunar* is almost circular is larger than the internal and has a groove on the outer side for the popliteus muscle. The anterior end is attached to the front of the tibial spine behind the anterior crucial ligament, with which it blends the posterior end is fastened behind the tibial spine in front of the rear attachment of the internal semilunar and just before this it gives off a strong fasciculus to be attached to the inner condyle of the femur close to the attachment of the posterior crucial ligament. In front it gives off another fasciculus known as the transverse ligament.

This architecture makes the anterior or external crucial ligament more vulnerable than the posterior or internal crucial because it is the weaker longer more oblique and it has fewer accessory supports. Likewise, the internal semilunar cartilage is more vulnerable than the external because the latter is larger more nearly circular it is grooved for a muscle the attachments front and rear are better protected, and it also has two fasciculi which are virtually ligamentous anchorages. It would appear as if additional natural defenses were purposely designed for the external margin of the knee to compensate for the absence of any articulating bony support. In this respect, as in many others, the structure of the elbow-joint is imitated. We know clinically that violence sustained by the elbow registers most often upon the inner margin of this articulation just as in the knee-joint. A similar parallel exists when we compare the wrist and ankle-joints, as in each of these the outer margin is more often injured than the inner. Colles fracture and Pott's fracture are manifestations of this selective action, lesions of the outer bone in each instance being the cardinal pathologic factor.

Clinically we are interested in knee pathology connected with (1) Synovia (2) crucial ligaments, (3) semilunar cartilages, (4) tibial spine or their sequelae, (5) loose bodies.

the joint. By contrast with the older method of continuous pressure and rest in extension, this newer procedure has the advantage of speed with certainty. It limits the possibility of stretching the synovial capsule and the parts contiguous. It prevents in a large measure organized exudate which is a very potential source of loose bodies, a great cause of re-effusion. It provides a means for bacteriologic study of the exudate. Given a case of acute or chronic traumatic synovitis, the procedure is to aspirate the joint at the site and in the manner above indicated for oxygen injection. All the fluid is aspirated and the removal is made the more complete by massaging the joint contents toward the needle. Occasionally a blood-vessel may be punctured, but this does not modify the procedure, nor does the presence of blood within the joint itself. After the needle is withdrawn the patient is made to move the joint by his own volition to a right angle if this is possible. Thereafter every two hours, voluntary or active motion of the joint is insisted upon and no dressings of any sort should be applied to interfere with this. If the patient is seen within a few hours of the injury the best procedure after aspiration is to make the patient walk and use the knee in as nearly a normal manner as possible. These early cases need not be kept in bed at all, for overactivity of the joint will become manifest by pain, heat and swelling but the appearance of these must not interfere with the active mobilization. Re-effusion usually occurs after the first day if it does not recede within the following twenty-four hours, re-aspiration should be performed in the same manner in the same zone but not through the same opening. It is very rarely necessary to aspirate more than twice.

Subacute or chronic traumatic synovitis is treated in the same manner but in these, atrophy of the contiguous muscles will require massage and the joint will be stretched enough to require the support of a linen-mesh or other bandage. It is this group and the recurrent forms in which x-ray examination of the air-injected joint will prove especially valuable in excluding loose bodies or other sources of intra-articular irritation.

Synovitis arising from distant or systemic sources of infection

Preliminary freezing with ethyl chloride makes the introduction relatively painless, and, needless to say aseptic precautions must be absolute. The caliber of the needle need not be larger than the diameter of the lead in an ordinary pencil. Enough oxygen is slowly introduced to completely and uniformly distend the joint, and the radiograms should be made within an hour otherwise full inflation will not persist. After the needle is

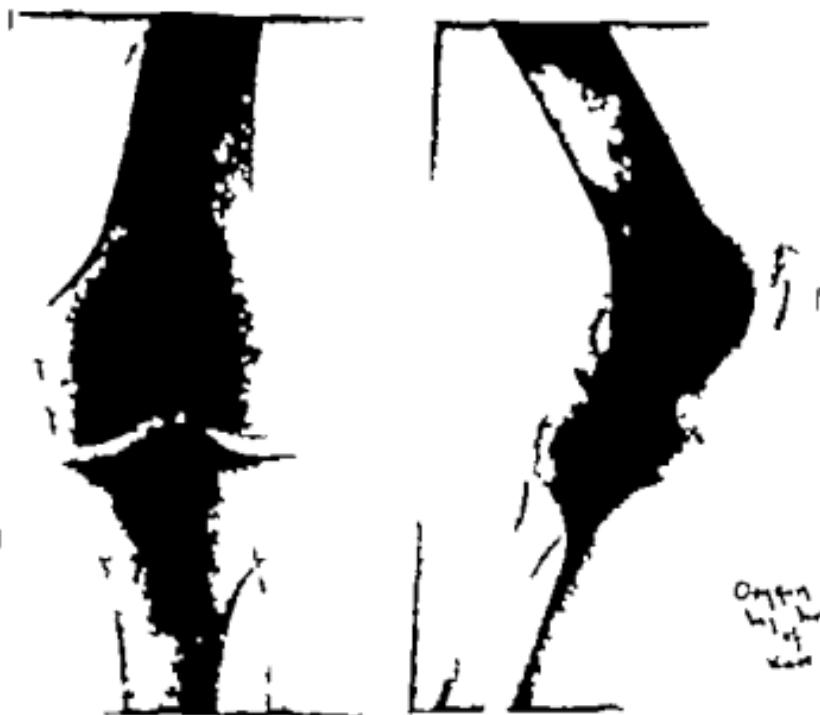


Fig. 697.—Oxygen-injected knee-joint.

Fig. 698.—Oxygen-injected knee-joint.

withdrawn the puncture site is covered by cotton and collodion, or a patch of sterile adhesive plaster. Radiograms should be made in four directions, namely from before backward and the reverse and from within out and the reverse. If any fluid is present in the joint it should be removed before introducing the oxygen. Carbon dioxide may be injected instead of oxygen.

Treatment of traumatic synovitis is most effective by the method of *immediate aspiration* and *immediate mobilization* of

secretion, and the joint is then supported on a pillow with the knee at or near a right angle so that the margins of the patella are separated at least 1 inch. Each two hours the joint is fully bent and fully extended the secretion being squeezed out during this motion. In certain cases it is advisable to allow the injured and the uninjured leg to dangle from the edge of the bed so that the knee is better kept at or near a right angle. If this is done, there will be less tendency for seepage into the popliteal space and in every case the rear of the joint must be carefully examined to prevent insidious progression along the back of the limb. This patella-split procedure will give as good spontaneous drainage as the procedure of cutting the patella tendon and lifting back the patella (the Mayo operation). It is far less disabling also for my experience with this last named procedure is that the joint can never again become properly socketed the leg always receding joint motion becoming practically abolished.

These are, of course, desperate cases, and any procedure short of amputation is all gain to the patient. In many of these cases general sepsis is of such a grade that spontaneous motion of the joint is beyond the strength of the patient and passive motions may be too painful. In such an event the intermittent irrigation of the cavity every two hours should be practised, but in the interval no drainage-tubing or material should be introduced. The irrigating solution may be ether iodin solution, saline solution, Dakin's solution, permanganate solution or any antiseptic of choice. Needless to say the general state of the patient should be safeguarded, notably as to relief from pain and a plentiful diet. These patients do very much better out of doors if the climatic conditions permit. No dressings of any sort should be applied because these virtually become pus poultices. It occurs to me that trephining the patella may prove efficient in a certain group in which the patella-split operation may prove too formidable.

Crucial ligament injury is not diagnosed as often as the occurrence demands, and I feel sure that we all have classified many cases as partial dislocation, synovitis, tearing of the lateral ligaments (especially the internal) and semilunar cartilage

does not come within the scope of these remarks, nor are we here concerned with tubercular syphilitic, or neurologic sources of origin. In passing it may be stated that syphilis must be suspected in any case of painless massive synovitis that occurs without adequate trauma. *Any synovitis that recurs after repeated aspirations and active mobilization is not ordinary uncomplicated synovitis and a constitutional source should be sought if an intra-articular irritant can be excluded.*

*Purulent synovitis* or joint empyema due to wounds or metastases may be said to appear in three types (a) Mild (b) moderate (c) severe

(a) Mild types are treated by repeated aspirations and mobilization. The injection of 2 to 4 drams of ether after each aspiration will be of decided benefit. I have used ether injections in war wounds with great satisfaction since the method was called to my notice by Major Lardenois, then Consultant of the Fifth French Army Corps with which I was serving.

(b) Moderate types are treated by a vertical unilateral or bilateral incision parallel with the other border of or just lateral to the margins of the patella. Each incision is to be at least 2 inches long, the fluid within the joint is forced out by joint motion or irrigated out with ether and thereafter the patient is made to move the joint himself each two hours (day and night) so that the joint contents are literally squirted out each time the articulation is bent or straightened. No encircling dressing must interfere with joint action as a matter of fact, no dressing need be used except when the patient is asleep. No irrigation of any sort is permissible except ether and this is used mainly because it leaves no residue after evaporation. No drainage-tubing or any other material enters the joint—drainage is entirely by the to-and-fro motion of the joint, which overcomes seepage prevents pocketing, promotes absorption, limits atrophy and inhibits adhesions.

(c) Severe types are treated by vertically splitting the patella after the manner described below (Jones operation). This permits a very wide exposure of the joint so that all portions of it are freely visible. Irrigation by ether rids the cavity of all

and posterior splintage for three to six weeks gradual motion being permitted thereafter. Massage is given from the onset and the patient can be permitted to walk if the splint is adjusted to prevent flexion and rotation. The outcome under this form of treatment is not particularly certain because repair of a much torn ligament cannot be relied upon if coaptation is not provided. Another defect is the possibility of associated injury notably of the tibial spine. Finally it is known that all the blood cannot be aspirated from the joint, and thus fibrin may become deposited, leading to the formation of loose bodies. A "slipping knee" will be the outcome if ligamentous union is not firm.

Operative treatment designs to reef or anchor the torn ligament to the femoral condyle by means of absorbable or non-absorbable sutures (silk or linen). The exposure is best obtained by the patella-split operation described below. Two holes are bored in the condyle of the femur and the sutures are passed through these after piercing the ligament. Gradual motion can be permitted after two to four weeks. This method gives a complete exposure of the joint so that all fluid can be removed and any associated damage repaired.

Obviously operation should be advised only for selected cases, and it is particularly indicated in the robust and in any case where doubt exists as to the actual extent of injury. If after a reasonable trial of non-operative measures slipping of the knee still persists, exploration is advisable as a substitute for apparatus. Robert Jones is rather inclined not to operate until conservative methods are tried for two to six months.

Semilunar cartilage injury is now demanding a larger share of attention because the diagnosis is being made more readily since we have learned that locking of the joint is not a necessary symptom. It is my opinion that during the war period more operations were performed for this condition by American surgeons than for the preceding two decades. In England this lesion has been diagnosticated with great frequency for many years indeed, in certain parts of Great Britain where mining is active semilunar involvement is almost an occupational disease.

involvement. The anterior crucial is much more often injured than the posterior. Indeed some authorities assert that injury to the posterior crucial is always preceded by injury to the anterior crucial. The tibial spine may be avulsed as a part of the ligamentous injury but either may occur independently.

**Causation**—Recalling that the anterior ligament is tense when the knee is extended and that it is attached to the front of the tibia and the back part of the external femoral condyle, we can see that internal rotation and abduction of the straight knee is the most probable causative factor. In other words, violent wrenching of the internally rotated or abducted knee may rupture the anterior crucial ligament. Very severe grades of violence are necessary to injure the posterior crucials, and, as stated, the injury is then usually of both crucials.

**Symptoms**—A painful hemorrhagic synovitis is the main finding. Manipulation of the joint may show that the tibia can be displaced forward on the femur if so the diagnosis of lacerated anterior crucial ligament is reasonably certain. If the reverse pertains (displacement backward of the tibia on the femur) the posterior crucial is involved. Excessive rotation (usually outward) of the tibia on the femur is an associated finding. The sound knee should be examined to ascertain the normal limits of motion because individuals vary in respect to physiologic knee motility.

If there is limitation to full extension, concurrent injury to the tibial spine must be regarded as probable.

The internal lateral ligament is usually more or less torn when the anterior crucial is involved.

Some authorities say that pain and disability in full extension is always present in anterior crucial injury and similar signs on flexion indicate posterior crucial injury but manifestly differentiation by such signs is unreliable.

The three cardinal signs are (1) Synovitis (2) excessive forward or backward motion of the tibia (3) excessive rotation of the tibia usually outward.

**Treatment** may be non-operative or operative. Non-operative treatment consists of aspiration of the bloody fluid,

injury but in greater degree depend upon the prior history of the joint. Mild moderate and severe grades of cartilage injury have already been mentioned and the symptoms correspondingly vary.

*Mild grades* are characterized by local severe pain accentuated by manipulation temporary limp and slight local effusion. After a few days manipulation of the joint may be wholly painless. These are 1 plus (+) cases in which a diagnosis of sprained knee is usually made.

*Moderate grades* give symptoms similar to the preceding but the pain is greater the disability is more prolonged, the effusion is more marked and manipulation of the joint is painful enough to call our attention to one margin of the articulation. These are the 2 plus (++) cases, in which a diagnosis of lacerated ligaments or synovitis is usually made.

*Severe grades* are associated with very severe pain, the patient falls, the joint is locked, disability is prolonged, the synovitis is extensive the tenderness over the cartilage persists a long time and very rarely a loose body may be palpable after the swelling subsides. These are the 4 plus (++++) cases in which the correct diagnosis is frequently made but in the absence of locking a diagnosis of synovitis is entertained.

Irrespective of the grade of injury we should be on guard in any case in which localized tenderness is apparent over a cartilage when the joint is manipulated and when direct pressure causes wincing. The occurrence of synovitis from indirect violence should also cause suspicion indeed, we should become very chary of making a positive diagnosis of uncomplicated sprain of the knee.

In order of frequency knee joint injuries may be said to consist of (1) Contusion-sprain (2) synovitis (3) lateral ligament injury (4) cartilage injury—subluxation, luxation fracture (5) fractures (6) crucial ligament injury (7) tibial spine fractures.

One main differentiation of importance is between cartilage injury and crucial ligament injury. In cartilage injury local tenderness and limitation of full extension are signs of great value.

I am convinced that in our country we have far more cases than we suspect, and we have masked or missed or massed the diagnosis as "recurrent synovitis," "rheumatism," "neuritis," "ruptured ligaments,"

The internal semilunar cartilage, as stated, is much the more vulnerable for the reasons already given. It is involved from twelve to thirty times more frequently than the external, these extremes representing the statistics of various operators. The rugged, robust athlete or workman is the usual victim and women are very rarely affected.

*Causes*—The essential factor is strain imposed upon the knee at a time when the joint surfaces are not apposed. When the knee is in a position of extension the condyles of the femur contact with the semilunar cartilages, thus protecting them even from direct violence. However when the joint assumes a position of flexion, this protection is withdrawn, the lateral and crucial ligaments are more or less in tension and any torsion of the joint brings pressure to bear on the semilunars themselves or upon the soft parts contiguous to them. Hence rotatory flexion of the joint with fixation of the leg or foot is the primary cause. Everman of the leg is the common form of torsion and in this position greatest strain is thrown upon the inner side of the joint, and hence the inner more vulnerable internal cartilage is much more often affected. A direct blow on the flexed knee may produce less often the same effect. Thus a misstep, an incomplete or broken fall, a sliding twisting motion of the joint, all these may dislodge a cartilage. A single act of violence may incompletely or completely dislodge a cartilage and the effect may produce symptoms varying from sudden sharp pain with little or no disability to complete locking of the joint with excessive disability. I am of the opinion that the initial act of violence may fracture dislocate or dislodge a cartilage and that another act of violence at a distant period may wholly detach a cartilage, perhaps even to the extent of making of it a loose body. It is unusual in my experience to find a distinctly loose or palpable cartilage as the end-result of one act of violence.

*Symptoms*—These are proportionate to the extent of the

without pain—these in combination justify operation, especially if the aspirated fluid is bloody.

The demonstrable presence of a loose body also justifies operation.

In a word operation is advised for any healthy patient who repeatedly wrenches the knee during ordinary activities, and in whom each attack is associated with pain, effusion, and tenderness. This type of case justifies the term "irritable knee" and removal of the offender is as much indicated as in recurrent appendicitis.

*Operation*—If the accused cartilage is definitely located a vertical 3-inch incision is made directly upon it, a hook is introduced and all or part of the cartilage is removed. The knee is best explored when in a right-angled position, and hence at operation it may be allowed to dangle over the end of a table. Needless to say every aseptic precaution must be taken, there must be no finger contacting with the wound all sponges must be held by holders all instruments must be handled by the operator alone and immediately after use placed in a pan of boiling water rinsed therein and replaced on the tray by an assistant who uses clamps for this purpose. This is the so-called "hands off" or "don't touch" technic, and scrupulous employment of it will render this operation perfectly safe. After the cartilage is removed the deeper parts are closed in three separate layers. The first layer by interrupted plain catgut shutting off the capsule the second layer by a similar stitch closing the deep fascia the third layer closes the skin and superficial fascia by interrupted non-absorbable sutures (silk, linen, silkworm horse-hair). The sterile gauze and cotton dressing is so applied that knee motion will not be interfered with, and the patient is forced to move the joint by his own volition just as soon as the effects of the anesthesia have disappeared. Every day thereafter at regular intervals (each two to four hours) the joint is bent and straightened and after a few days walking is permitted. No splintage of any sort is allowable in this active mobilization procedure. If postoperative effusion is uncomfortable, the joint is aspirated after the plan indicated this is repeated if necessary.

In crucial ligament injury rotation of the knee is increased and likewise forward and backward motion of the joint is relatively free. In recurrent cases, in the so-called slipping knee, the diagnosis generally rests between these two conditions.

The x-ray examination as ordinarily made is not of much value, but if the joint is injected with oxygen very much greater information will be obtained. The procedure has the added value of permitting aspiration of the fluid preliminary to the oxygen injection, and this is the most efficient treatment for the synovitis. In an ordinary x-ray examination negative findings with definite symptoms is suggestive of intra-articular loose bodies or cartilage injury.

**Treatment.**—*A non-operative*—Minor grades require little if any attention. Strapping with adhesive will give a sense of security and aid in reducing effusion if any exists.

Moderate grades require treatment for the synovitis, and this is best accomplished by aspiration. When all the fluid is removed the joint should be loosely encased in a linen-mesh bandage and placed on a pillow in full extension. Each day the knee is slowly bent by the patient almost to a right angle, until by the end of a week full right-angled flexion is attained. Rotatory motions are restricted for several weeks. Then walking is permitted freely the joint to be protected against sudden flexion and rotatory motions by a suitable support.

Severe grades are treated by unlocking the joint through the medium of strong flexion, traction on the bent leg, rotation toward the lesion, and extension. Anesthesia occasionally is needed for this. Effusion is aspirated. Rest in extension is provided as in the preceding variety. Walking is allowed when pain on pressure and motion subsides and some form of protection is provided.

*Operative treatment* will be advised only when the diagnosis is confirmed by physical examination, by the x-ray or by the history of repeated attacks of pinching or slipping of the knee associated with local pain, effusion, or locking.

Recurrent attacks of synovitis, persistent joint weakness, a sense of joint insecurity inability to perform certain motions

without pain—these in combination justify operation, especially if the aspirated fluid is bloody.

The demonstrable presence of a loose body also justifies operation.

In a word operation is advised for any healthy patient who repeatedly "wrenches the knee" during ordinary activities, and in whom each attack is associated with pain, effusion, and tenderness. This type of case justifies the term "irritable knee," and removal of the offender is as much indicated as in recurrent appendicitis.

*Operation*—If the accused cartilage is definitely located a vertical 3-inch incision is made directly upon it, a hook is introduced, and all or part of the cartilage is removed. The knee is best explored when in a right-angled position, and hence at operation it may be allowed to dangle over the end of a table. Needless to say every aseptic precaution must be taken, there must be no finger contacting with the wound, all sponges must be held by holders all instruments must be handled by the operator alone and immediately after use placed in a pan of boiling water rinsed therein, and replaced on the tray by an assistant who uses clamps for this purpose. This is the so-called "hands off" or don't touch technic, and scrupulous employment of it will render this operation perfectly safe. After the cartilage is removed the deeper parts are closed in three separate layers. The first layer by interrupted plain catgut shutting off the capsule, the second layer by a similar stitch closing the deep fascia, the third layer closes the skin and superficial fascia by interrupted non-absorbable sutures (elk, linen, silkworm, horse-hair). The sterile gauze and cotton dressing is so applied that knee motion will not be interfered with, and the patient is forced to move the joint by his own volition just as soon as the effects of the anesthesia have disappeared. Every day thereafter at regular intervals (each two to four hours) the joint is bent and straightened and after a few days walking is permitted. No splintage of any sort is allowable in this active mobilization procedure. If postoperative effusion is uncomfortable, the joint is aspirated after the plan indicated this is repeated if necessary.

In three to four weeks the full use of the joint may be permitted without restraint.

When the diagnosis is not wholly clear the patella-split operation advocated by Robert Jones will give better access. This is performed by hanging the knee over the end of the table and making a vertical incision from above the top of the patella to and beyond the lowest limit of the knee-cap. The edges of the skin are immediately protected by towels, and then the patella is bisected vertically by a metacarpal or other saw. The saw cut cannot be made wholly through the bone except with a rotary saw but the section is readily completed with a few blows on a broad thin woodcarver's chisel. The edges of the patella are now drawn apart by retractors, and if the entire joint interior is not thus exposed, the incision is enlarged upward through the quadriceps tendon, or downward through the patella tendon. Loose bodies, accessory fat pads, synovial fringes, or other intra-articular lesions are now fully exposed. The crucial ligaments, the tibial spine and the semilunar cartilages are also brought into view. Before closure the joint should be flexed and extended several times so that any loose bodies hidden in the intracondyloid space may be dislodged. A few bleeding points at the upper and lower limits of the incision will require ligation, but, aside from these bleeding is usually unimportant. Needless to say all of the operation should be of the "fingers off" or "touch-me-not" technique, so that hand contacting will be eliminated. The interior of the joint should be bloodless and relatively dry before suturing begins. Closure is made by passing interrupted catgut sutures through the quadriceps tendon and then through the patella tendon, the knee being in extension when these are placed. The patella will be drawn into place by these and now a continuous or interrupted series of catgut titches will serve to unite the deep fascia. A final layer of interrupted non-absorbable stitches now unites the skin and superficial fascia. A light molded plaster-of-Paris or other splint is placed on the posterior surface reaching from the middle of the thigh to the middle of the leg. This splint is

removed next day and the patient is made to move the knee as far as possible the splint to be replaced thereafter. Each day this is repeated and after the stitches are removed (about the seventh day) the splint is discarded and the patient is forced to move the joint many times daily. In selected cases I use no splint. Joint effusion that does not subside on the third day after the operation is removed by aspiration. Respiration may rarely become necessary. Walking should be encouraged after the splint is removed. If the joint becomes hot, swollen or painful, a cold wet dressing of saline or boric solution will be effective unless infection has occurred. Joint reaction in the absence of infection usually means too active usage. At the end of the second or third week, and in some cases earlier flexion of the knee to a right angle may be expected.

Exposure of the joint through a unilateral or bilateral vertical incision at the margin of the patella gives such inadequate access that this procedure is wisely limited to well selected cases. The U-shaped incision cutting through the patella tendon is needlessly mutilating and is rarely employed.

Explorations of the knee so much resemble abdominal explorations that the term "laparotomy of the knee-joint" is well justified. The patella can by comparison be looked upon as the rectus muscle and accordingly our approach to the parts beneath can be lateral, central, or transverse depending upon the access desired. As in abdominal lesions, exposure of the knee-joint should be so planned that the operation will be in every sense exploratory and for that reason a transpatellar arthrotomy has the same merits as a transrectus laparotomy.

Spine of tibia injury is relatively rare and is frequently associated with rupture of the crucial ligaments, principally the anterior crucial. Robert Jones says that Godlee in 1888 first called attention to this lesion in a limb that had been amputated by Erichsen fifteen years previously. In all probability the tibial spine is avulsed in many cases of dislocation of the knee and it may also be an accompaniment of intra-articular fractures of the head of the tibia. Hence severe forms of vio-

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lence are producing causes, and doubtless the diagnosis is shrouded in the synovitis which inevitably appears, and the differential diagnosis rests between this and crucial ligament injury bearing in mind that the latter and tibial spine avulsion may coexist. Robert Jones in 1913 reported having seen 17 cases in three years, and he says "the most constant sign of fracture of the spine of the tibia is obstruction to full extension. The block feels like a definite bony obstruction and is quite different from the locking which occurs when a dislocated semilunar cartilage is nipped." He says there are three forms (1) Avulsion of the tibial spine or its internal tubercle (2) fracture of the external tubercle of the spine (3) injury of the spine combined with fracture of the tibial tuberosity. In Class 2 fracture of the external tubercle of the spine Jones states that it is unconnected with injury of the adjacent ligaments, but that it is sheered off by the external condyle of the femur. The first operation for the repair of a fractured tibial spine and ruptured anterior crucial ligament was performed in 1907 by Hogarth Pringle (Robert Jones).

*Treatment* is non-operative or operative. Prolonged rest cures most cases, and Jones advises this for a period of two to four months. In severe or resistant cases he sutures the spine by a transpatellar approach, anchoring at the same time the anterior crucial ligament so often coincidentally involved.

Cooper is an advocate of operation in all cases, believing that disability is lessened and that the associated lesions are thus better treated.

The writer has never seen a case of this sort, but on theoretic grounds at least would place the injury in the operative class mainly because of the associated crucial ligament injury which is best treated by suture as already indicated.

**Loose Bodies.**—It is interesting to note that these were first recognized by Ambrose Paré in 1558.

Essentially all are due to disease or trauma. Structurally they may be said to be in the main fibrous or composed of

organized connective tissue which may contain distinctly cartilaginous or bony elements.

Numerically they may be solitary or may number many hundreds. Berry in 1894 removed 1047 from a man kicked by a horse. In size they vary from a pinpoint to that of an egg. In location they may be found in any part of the joint they may be wholly free dangling from a pedicle or more or less attached as an excrescence.

In duration they may be ancient, moderately old or recent.

In incidence as to age, sex or occupation they generally are found in males between twenty and forty-five, in the active or the sedentary clinically however most cases are found in active healthy workingmen or athletes.

The chief diseases with which they are associated are rheumatoid arthritis, osteo-arthritis, Charcot's joint, some neuropathies, osteochondritis. Certain definite but etiologically undetermined causes may also be productive such as osteochondritis dissecans, first described by Koenig in 1887 in this a definite body is found under the femoral condyle in a niche and this is supposed by some to arise from a circumscribed necrosis due to the plugging of terminal vessels. I operated on such a case recently. Weir reported 2 cases sarcomatous in type and he first called attention in 1892 to the peculiar organization of the subpatellar fat and fringes so well recognized and emphasized later by Comer and others. Certain fatty bodies also develop in the synovial fringes, and this condition is called lipoma arborescens.

From traumatic sources loose bodies originate from

(1) Synovitis in the form of fibrous tissue fat hyaline cartilage or bone.

(2) Synovial tears or contusions, a fibrinous clot later becoming converted into cartilage or bone which may become wholly detached or remain pedicled. This form is rare.

(3) Semilunar cartilage detachment which is ordinarily incomplete

(4) Articular cartilage separated from the femur tibia or patella

(5) Foreign bodies introduced from without.

(6) Articular fracture of the femur or tibia.

From a practical standpoint the loose bodies consequent upon synovitis articular cartilage or semilunar detachment are the most frequent, and give rise to symptoms of a relatively constant, almost classical type.

*Symptoms*—The typical combination is pain, synovitis, weakness and slipping or locking followed by re-effusion.

*Pain* may be constant, intermittent, localized, or diffuse. Certain motions and pressure may increase it. In type this pain may be dull, or it may be stabbing and at times exceedingly severe in its darting character. Pressure may elicit tenderness, and when this occurs, valuable corroborative evidence is given.

*Synovitis* is rarely extreme unless a severe attack of locking occurs. Usually the synovial pouch is rather uniformly distended and a feeling of thickening rather than fluctuation is obtained. Crepitation may or may not exist.

*Weakness* is common and the patient is not sure of the joint, notably in going up and down stairs.

*Slipping* may be marked or trivial.

*Locking* may be complete, but is generally incomplete so that the flexed position does not require much self-manipulation for correction. Attacks of marked locking requiring surgical aid are relatively rare except in displacement of a semilunar. Such an occurrence is not the rule in ancient cases because the joint cavity in these is so distended by repeated irritation that the offending body usually has plenty of space for wandering about.

*Re-effusion* is most marked when the offender has caused considerable reaction because it becomes nipped, pinched, or impaled in a space where bone ends normally contact for this reason the most massive re-effusions occur from irritation of the inner side of the joint.

Certain accessory symptoms may also occur and of these the most important are (1) Increased motility of the joint as expressed by undue anteroposterior, lateral, or rotatory motions (2) palpatory evidences of a loose body often first located by the patient.

$\alpha$  Ray examination may fail to give any information of value unless the loose body is bony or more or less opaque. Occasionally the margins of the articulation may be so irregular that erosion from within is suggested. As already indicated injection of oxygen into the joint will often bring into view loose bodies otherwise invisible. This procedure has the added value of allowing us to aspirate the joint contents so that the synovitis is relieved and the joint exudate can be examined microscopically if desired.

*Treatment*—Palliative measures have no certain value and in selected cases operative removal by the transpatellar approach is the method of choice. The indications for operation may be said to be

- (a) Palpatory or  $\alpha$  ray evidence of loose body
- (b) Continued intra-articular mischief that cannot be ascribed to constitutional causes.
- (c) A combination of continued or intermittent pain, synovitis, weakness, locking and re-effusion.

*Conclusions*.—1 Mono-articular lesions of the knee not definitely tubercular, syphilitic, neuropathic, or metastatic are presumptively surgical as to origin and cure.

2. Synovitis due to indirect violence is very often an end-result of intra-articular damage represented by lesions of the semilunar or their contiguous spines, crucial ligaments, or articular cartilages.

3 A prolonged combination of pain, synovitis, weakness, slipping or locking is indicative of intra-articular irritation from a detached or pedicled body.

4  $\alpha$  Ray examination of the oxygen-injected joint is a valuable diagnostic aid.

5 Joint effusion is best treated by immediate aspiration and mobilization.

6 Operative exposure to be of greatest value should be by the transpatellar route which gives access to the entire joint cavity.

7 Early mobilization following operation is an essential to success.

8 Operative attack demands ultra-asepsis.

- (5) Foreign bodies introduced from without.
- (6) Articular fracture of the femur or tibia.

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## CLINIC OF DR. WILLIAM A. DOWNES

St. LUKE'S HOSPITAL

### JEJUNOSTOMY ITS VALUE IN THE TREATMENT OF CERTAIN ULCERS OF THE STOMACH AND AS A PALLIATIVE MEASURE IN INOPERABLE CARCINOMA OF THE STOMACH

#### FULL HISTORY AND DISCUSSION OF TWO CASES; DESCRIPTION OF TECHNIC OF OPERATION

I WISH to present 2 patients illustrating the value of jejunostomy in the treatment of certain ulcers of the stomach and to call attention to the use of this procedure as a palliative measure in inoperable carcinoma of the stomach. Also to describe the technic which in our hands has proved satisfactory

#### CASE I

The first patient, A. J. colored, aged eighteen. Admitted to the Medical Service on March 3 1921

**Chief Complaint**—Pain in epigastric region and vomiting Present attack of three weeks' duration

**Present Illness.**—Three weeks ago patient had a dull gnawing pain in epigastric region, which radiated to the left shoulder and into the back. Pain came on one to one and one-half hours after meals. Not relieved by food, but slightly relieved by taking a cup of hot milk. Irregular vomiting but vomitus did not contain blood. Stools tarry. Rapid loss of strength, with shortness of breath. Remained in bed three days before he came to the hospital.

**Past History**—Pain in stomach first began three years ago and at that time was treated at the Presbyterian Hospital for two and one-half weeks. Nine months later pain returned, and was again treated for one week at the same hospital. One year



12 ounces. There was only a slight improvement following the transfusions, and as his general condition seemed to be getting



Fig. 699

worse rather than better he was transferred to the Surgical Service on March 25th and was operated upon on the same day

ago received electric treatment at the Neurologic Institute. Shortly afterward was in the New York Hospital for two weeks, where he was put on a diet and remained free from pain up to the present attack. Pneumonia five months ago. No other illness. Denies venereal diseases.

**Family History**—negative

**Physical Examination**.—Patient is a much undernourished and underdeveloped negro boy aged eighteen, lying quietly in bed and appearing acutely ill. Lips and mucous membranes ashen gray. No cyanosis, no petechiae, no jaundice, no edema, no dyspnea.

Posterior cervical, axillary and inguinal glands felt. Thyroid not felt.

**Eyes**.—Pupils regular equal, contracted, react to light and accommodation. Extra-ocular movements normal.

**Teeth**.—Denty and carious. Tongue dirty tonsils enlarged.

**Abdomen**.—No masses. Somewhat scaphoid. Has marked tenderness in the epigastrum and there is rigidity of the right upper rectus. Liver, kidneys, and spleen not felt.

Weight 84 pounds.

**Laboratory Findings**.—Red blood-cells, 2,400,000. Hemoglobin, 32 per cent. Morphology normal. Stool for blood, guaiac 3+ positive. Wassermann negative.

**Röntgen-ray Examination**.—There is marked deformity of the stomach. The pyloric end and lesser curvature indicate gastrospasm. The appearance of the lesser curvature suggests the possibility of perforating ulcer. The findings are sufficient to indicate the advisability of surgical intervention. The condition of the patient was such that fluoroscopic examination was not permitted. The plates were taken only in a prone position. The stomach emptied at a fair rate. There is a retention of about one-quarter of the meal at the end of four and one-half hours.

**Provisional Diagnosis**.—Bleeding ulcer of the stomach. Location, lesser curvature and posterior wall. The patient was put on an ulcer diet (Bastedo) and on March 11th was given a blood transfusion of 13 ounces, and on March 19th another of

12 ounces. There was only a slight improvement following the transfusions and as his general condition seemed to be getting



Fig. 609

worse rather than better he was transferred to the Surgical Service on March 25th and was operated upon on the same day

Operation.—Gas and oxygen anesthesia. Exploratory gastro-tomy jejunostomy. Five-inch upper right rectus incision.

**Pathologic Findings and Operative Procedure.**—Dense perigastric adhesions between the lesser curvature of the stomach, the parietal peritoneum and liver. A large indurated mass could be felt involving the lesser curvature and posterior wall of the stomach and apparently adherent to the pancreas. Pylorus patent and not involved. Duodenum normal. A 3-inch incision was made in the middle of the anterior wall of the stomach exposing the ulcer crater. The ulcerated area was

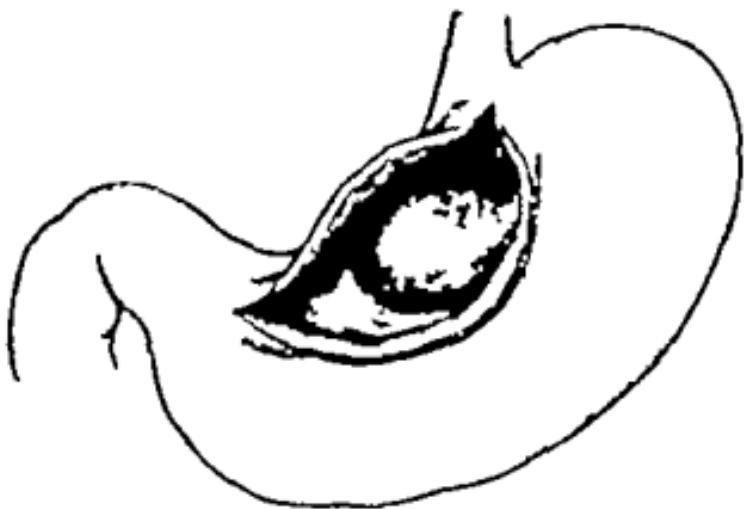


Fig. 700.—Illustrating location of ulcer in Case 1.

about 3 inches in diameter and extended well up on the posterior wall and lesser curvature (Fig. 700). On account of the size and location of the ulcer excision was impossible. The opening in the stomach was closed by a continuous suture of chromic catgut, and the question of gastro-enterostomy considered, but, on account of the extent and location of the ulcer and the fact that absolute rest of the stomach was necessary in order to control the bleeding, which was the most important indication, this operation did not seem to meet the requirements. We therefore decided to perform jejunostomy thereby placing

the stomach at absolute rest in the hope that the bleeding might be controlled.

**Postoperative Treatment and Course**—Feedings through the tube in the jejunum were begun in twenty four hours 4 ounces of milk was given every two hours, gradually increased to 8 ounces with addition of eggs, meat juice and cereal. Small quantities of water were allowed by mouth. Continuous Murphy drip of 5 per cent. glucose. Three postoperative transfusions were given at intervals of two weeks. Wound healed by primary union. Convalescence was slow but satisfactory.

*June 21 1921*—Three months after operation red blood-cells 3,000,000 hemoglobin 45 per cent. Stools negative for blood.

Discharged from hospital on July 1st, having gained 10 pounds in weight and general condition much improved. At that time was allowed small quantities of milk ice-cream and broth by mouth, in addition to regular three-hour interval feedings through tube.

Has been returning to the hospital weekly since discharge. The same routine feeding has been kept up with moderate increase of amounts of food by mouth. Tube has been removed from time to time to be cleansed. There has been no irritation of the skin and no leakage from the stoma.

At this time (November 15th) patient appears to be in excellent health. Has gained 36 pounds in weight and has returned to his work as chauffeur.

**Laboratory Findings (November 15 1921)**—Examination of stool for blood is negative.

*Gastric analysis* fasting Free hydrochloric acid 0 Total 10 Gualac, + Test meal Free hydrochloric acid 30 Combined hydrochloric acid 40 Total 70

Blood count as follows: Red blood-cells 4,600,000 Hemoglobin 74 per cent. White blood-cells 7000 Polynuclear leukocytes, 60 per cent. Lymphocytes, 38 per cent. Eosinophil 1 per cent. Basophils 1 per cent. Morphology normal.

**x-Ray findings** (October 15 1921) showed the following. Fluoroscopic and radiographic examination indicate a most

remarkable improvement in the contour of the lesser curvature. The irregularity and tendency to the formation of a crater have



Fig. 701

entirely disappeared. The pyloric end of the stomach however is irregular in contour—in all probability due to the retraction

resulting from the healing of the ulcer. The greater curvature of the stomach is well rounded out. The stomach begins to



Fig. 702.

empty readily. The exposure made at three and one-half hours shows almost the entire meal has left the stomach and entered the colon. The tube in the Jejunostomy opening remains in

Exploratory operation advised and accepted.

Provisional Diagnosis.—Carcinoma of the stomach.

Operation (November 5 1921)—Gas and ether anesthesia.

Exploratory gastrotomy Jejunostomy Five-inch upper right rectus incision.

**Pathologic Findings and Operative Procedure.**—No adhesions. Liver appeared normal. No glandular enlargement. Pyloric portion of stomach normal. An indefinite mass could be felt occupying the cardiac portion of the greater curvature.

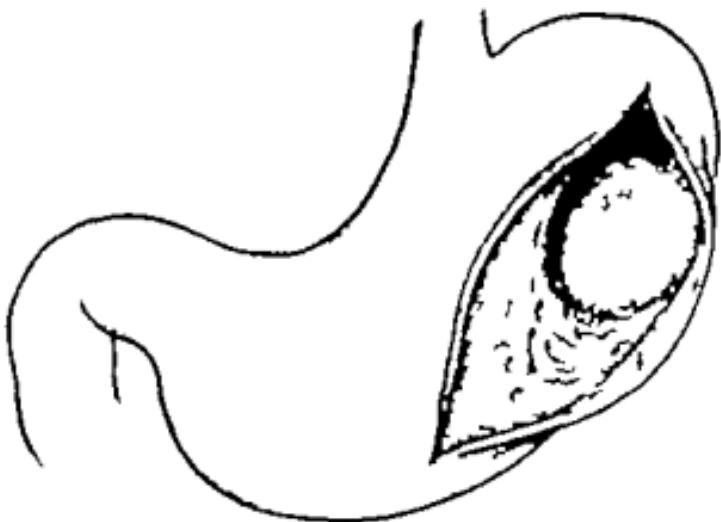


Fig. 704.—Illustrating location of ulcer in Case II.

The stomach was explored through a 3-inch incision in the middle of the anterior wall. An ulcer the crater of which was fully as large as the palm of a hand could be seen high up on the posterior wall and greater curvature (Fig. 704). On account of its inaccessibility no attempt was made to remove a section. As it was impossible—both on account of the size and location of the growth—to perform a radical operation, it was decided to do a jejunostomy. Complete rest of the stomach was indicated in order to control the bleeding.

The postoperative treatment has been carried out the same

as in the first case. Convalescence has been rapid. In three weeks there has been an increase of over 1,000,000 red blood cells and the hemoglobin has gone up 10 points.

We will be guided as to the future care of this patient by the laboratory and Roentgen-ray findings. If everything goes well we expect to keep the jejunostomy open for from six months to one year.

#### DISCUSSION

Ulcer of the stomach in individuals as young as eighteen is very rare. Lockwood states that in 100 private cases of gastric and duodenal ulcer only 2 were under twenty years of age.

There is little or nothing in the history of our first case to throw light upon the etiology. The oral sepsis or enlarged tonsils might be the cause. It was first thought that syphilis might be the causative factor but repeated Wassermann examinations have been negative, and there are none of the usual stigmata of congenital lues. The one feature suggestive of syphilitic origin was the presence of the extensive perigastric adhesions found at operation, but the ulcer itself was single whereas in syphilis there are usually two or more ulcers in varying stages of healing.

In the second case there is a fair chance that the ulcer is of a syphilitic nature, and for this reason we believe that under appropriate treatment and with complete rest of the stomach we may be able to obtain a cure. At any rate it seemed wiser to treat the patient on the assumption that it is not malignant. If it should turn out to be cancerous, no harm has been done.

The value of jejunostomy in the treatment of large gastric ulcers situated on the posterior wall and greater curvature was called to my attention by a case shown before the New York Surgical Society by Dr. Lillenthal (Annals of Surgery vol. 61 1915). Gastro-enterostomy had been previously performed on this patient without relief of symptoms, and he was later relieved—if not entirely cured—by jejunal feeding. While the field for jejunostomy in the treatment of chronic diseases of the stomach may be a limited one yet the indications are clear and in properly selected cases it is a life-saving procedure. In itself it may prove to be a curative measure or it may tide the

patient through a critical period until such time as an elective operation can be performed. As a palliative procedure in cancer of the cardiac portion of the stomach jejunostomy is superior to gastrostomy for the reason that it gives the stomach complete rest and if properly performed does not leak.

#### TECHNIC OF JEJUNOSTOSIS

A loop of the jejunum about 12 inches from the duodenal-jejunum angle is drawn out of the wound and grasped on its convex

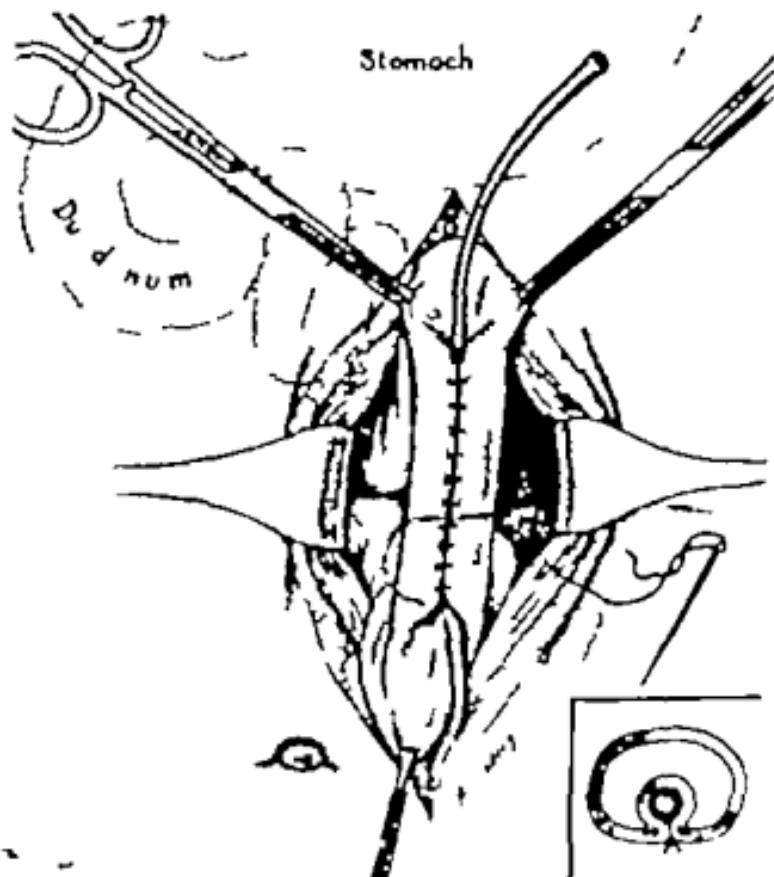


Fig. 705.—Jejunum supported by Allis clamps, about 3 inches of catheter introduced. Note small incision for passage of catheter set. Lumen of gut. Insert: Cross-section of intestine with embedded catheter.

surface by two pairs of Allis clamps placed opposite each other and about  $\frac{1}{2}$  inch apart. A third Allis clamp is now placed 4

inches distal to the first two grasping the gut wall in its center that is, at a point equidistant from its mesenteric attachment. Thus supported, the terminal 4 inches of a No. 16 French catheter is placed along the intestine and embedded in its wall by a continuous silk suture in a manner similar to Witzel's gastrostomy. This suture is started just distal to the two clamps and should include only enough tissue to completely embed the catheter care being used not to encroach too much upon the lumen of the gut. After the suture has been continued for about 3 inches a  $\frac{1}{2}$ -inch stab wound is made through

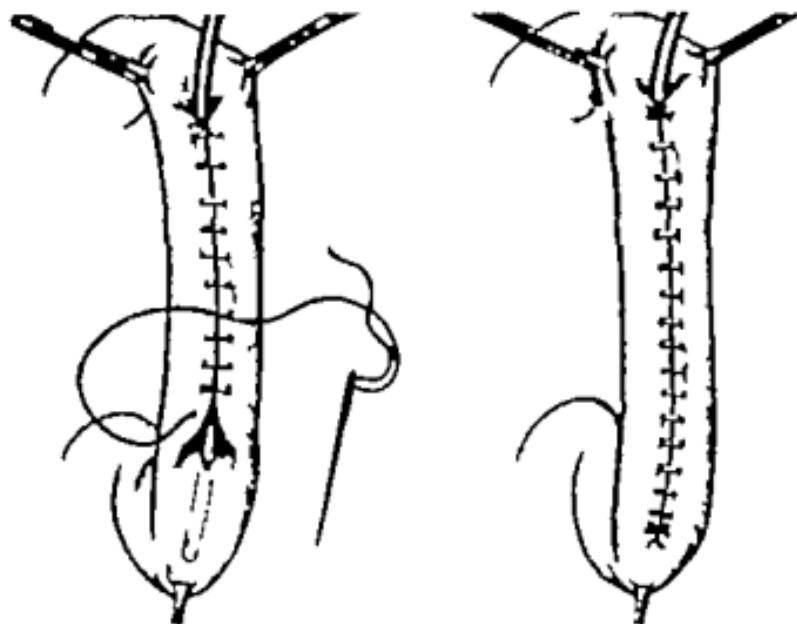


Fig. 706.—Catheter inserted into intestine. Suture completed.

the intestinal wall and the terminal inch of the catheter thrust into its lumen—the suture is then continued down to the single Alha clamp. The intestine is now dropped back into the abdomen, and anchored to the peritoneum about opposite or a little below the umbilicus by four silk sutures placed around the point where the catheter emerges from the trough in the gut. The abdominal incision should be made preferably through the left rectus muscle but if it has been placed to the right of the

median line it is not necessary to make a second incision. The catheter is caught to the fascia by an encircling suture of chromic gut and to the skin by a second one of silk. A transfixion suture is not used, as it may result in leakage. We have now used this method in 6 cases. There has been little or no leakage. The

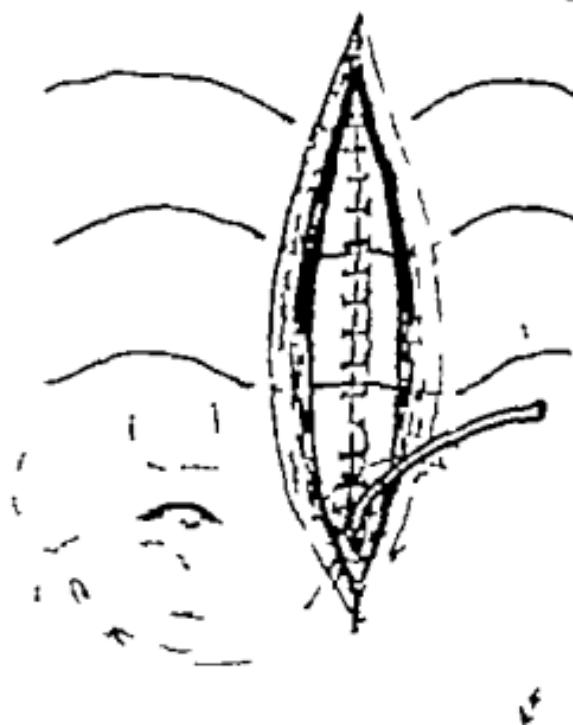


Fig. 707.—Jejunum attached to parietal peritoneum.

catheter is easily held in place by a narrow adhesive strip after sutures are removed. It should be removed occasionally for cleansing but should never be left out until it is time to let the stoma close. We have had no difficulty in reintroducing the catheter.

## CLINIC OF DR. R. W. BOLLING

ST. LUKE'S HOSPITAL

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### FIBROCYSTIC LESION OF UPPER PORTION OF SHAFT OF FEMUR

Recurring Fracture Through Fibrocystic Lesion of Upper Portion of Shaft of Femur Persistence of Lesion Following Union of Fracture Open Operation with Sliding Bone-graft.

The patient whom I present to you today is shown not only because the condition is relatively uncommon, but because the treatment in this instance furnished a problem of some interest.

He was first admitted to St. Luke's Hospital six years ago when he was fifteen years old. The day before admission, while running he felt his left thigh give way. He fell to the ground and was unable to get up. Two weeks previously he had fallen down an areaway but had felt no ill effects other than a dull pain in his hip. His history was otherwise entirely negative save for the fact that when he was nine years old he broke his right arm in the region of the elbow.

On admission he was found to have a fracture through the upper portion of the shaft of the left femur. At this time he was under the care of Dr. Richard Derby. He was treated by means of Buck's extension for twenty three days, at the end of which time a plaster-of-Paris spica was applied. Two months later he was discharged with solid union and 1½ inches shortening.

The radiographic report by Dr. Le Wald on admission is as follows: "There is apparently a pathologic fracture involving the left femur at the juncture with the neck. There is a peculiar rarefied appearance to the bone in this region suggesting decalcification."

Service of Dr. William A. Dowd, M.D.

cification such as occurs in bone cyst or in new growth. Four months after the fracture Dr. Le Wald reported. The fracture appears to have entirely united with some callus formation. There are still peculiar rarefied areas in the femur over the upper third and extending into the greater trochanter and the neck. Eighteen months after the fracture Dr. Le Wald states "There is still some evidence of rarefaction of the upper third of the femur and slight productive changes along the inner surface of the bone in the region of the fracture. Unfortunately these radiographic plates were destroyed.

Following his discharge from the hospital the patient led an apparently normal active life his only disability being a slight limp which was corrected by a raised inner sole. Eighteen months ago he was readmitted to Surgical Division A, St. Luke's Hospital and assigned to me for treatment. Two days before admission he slipped on the ice, falling on his left hip. Following this fall there was a dull ache in his hip. The next morning he slipped on the stoop and fell down several steps. The left thigh felt as though it gave way under him, and although he had no pain other than a dull ache in his thigh, he was unable to use the leg and knew from previous experience that it was broken.

On admission he was found to have a fracture through the upper portion of the shaft of the left femur at the level of the lesser trochanter. There was  $2\frac{1}{2}$  inches actual shortening. Otherwise his physical examination was negative. He was well developed and nourished, and the usual laboratory tests were made and found to have no bearing on his present condition.

The report by the radiographer Dr. Le Wald on admission is as follows: "There is a pathologic fracture passing through the upper portion of the shaft of the femur at the level of the lesser trochanter with upward and outward displacement of the lower fragment. The markedly cystic rarefaction of the upper portion of the shaft of the femur is evident, and is of about the same appearance as that noted in the radiograph taken three years ago. In view of the long standing of the condition it probably represents a bone cyst."

A Thomas splint with adhesive traction was applied with the

thigh flexed, abducted and rotated outward. This position was maintained by means of an overhead frame and at first a 30-pound weight was used. This was subsequently reduced. The method of traction was that described and pictured by Dr. Blake in his book on Gunshot Fractures of the Extremities.



Fig. 708.—Ten days after fracture.



Fig. 709.—Two months after fracture.

Figure 708 is a radiograph taken ten days after admission with the extension apparatus in place. A plaster spica was applied six weeks after fracture.

Figure 709 was taken two months after fracture and showed the position to be good, with no apparent shortening, but little regeneration of bone.

After eight weeks the plaster spica was removed and union

seemed solid. Dr Le Wald at this time reported that rarefaction in the upper portion of the shaft was still marked. One month later and four and one-half months after his fracture the patient was discharged with apparently solid union and  $1\frac{1}{2}$  inches shortening about the same amount noted on his previous discharge.

During the next six months radiographs were made at frequent intervals. The rarefied areas remained noticeable in the



Fig. 710.—Ten months after fracture

upper portion of the shaft of the femur tending rather to increase than to decrease. At this time radiographic examination of the entire skeleton was carried out and no further cystic areas were found.

Figure 710 represents the condition of the bone at this time. There was a well-defined and trabeculated cystic area in the upper extremity of the femur not involving the epiphysis and without change in the surrounding bone and periosteum. This, with the

five-year history and the age of the patient, made the diagnosis of a fibrocystic lesion practically certain. Operation was decided on, and the patient was readmitted to the hospital.

Four days after admission and ten months after the fracture, under gas and ether anesthesia, an incision was made along the outer side of the thigh, exposing the upper half of the outer aspect of the left femur. For a distance of about 4 inches the upper portion of the femur including the greater trochanter and the shaft immediately below it, but not the neck, was involved in the pathologic process. The bone in this region appeared to be irregularly elevated to a slight degree in rounded areas of varying size. The periosteum was apparently intact and slightly if at all, thickened, and everywhere a shell of bone of varying thickness covered the underlying cavities. The cavities varied in size from that of a pea to one with a diameter of about  $1\frac{1}{2}$  inches. This cavity contained a brownish fluid, which was thin and not viscid. The cavity was lined with a thin layer of rather firm tissue. Other cavities were apparently unlined and some were partly filled with soft, rather vascular brownish red material somewhat resembling very soft granulation tissue, though not so bright in color.

With the motor twin saws a strip including the entire thickness of the bone was cut, about 9 inches in length and  $\frac{1}{2}$  inch in width from the lateral aspect of the femur extending downward from the greater trochanter. The upper portion of this strip included portions of the cystic cavities described above. The cystic portion of the strip was cut away and discarded. The remaining cavities in the shaft of the bone were cureted as carefully as possible, and in certain instances the walls were crushed in. Small fragments of bone obtained from one end of the graft were placed in the cavities. The portion of the graft derived from the sound shaft of the femur was fixed in place in the cystic area by means of three kangaroo sutures passed through holes drilled on either side of the bone channel. In the lower part the graft was fixed below the surface of the femur this being made possible by the crushing in of the small cysts lying along the bottom of the bone channel. There was very

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of the incision and 90 c.c. of serosanguineous fluid withdrawn. Culture remained sterile. Five days later 120 c.c. of similar fluid were withdrawn and culture showed *Staphylococcus albus*, a probable contamination, as a few days later a third and last aspiration obtained 50 c.c. of similar fluid of which a culture remained sterile. There was no further complication and the patient was discharged eight weeks after admission.



Fig. 712.—Three months after opera-  
tion. Bone-graft.



Fig. 713.—Six months after opera-  
tion. Bone-graft.

Figure 711 is a radiograph of condition at this time.

Figure 712 shows condition two months later at which time Dr. Le Wald states. The bone-graft is well incorporated but its identity can still be made out. There is an increase in new bone structure where rarefaction has previously been noted.

active bleeding from the affected area of bone and the sutures in the muscle were so introduced as to roll muscle into all the inequalities in the surface of the bone. The wound was closed without drainage. A plaster-of-Paris spica was applied.

The microscopic examination by Dr. Knox the resident pathologist, follows: "Section shows fragments of bone, many of them rarefying, but others surrounded with a normal number of osteoblasts. The stroma all shows an inflammatory reaction. There is no normal marrow except a small amount of fatty



Fig. 711.—Six weeks after operation. Bone-graft.

tissue and this contains large dilated sinuses, but very few cells. There is a small amount of perosteum which is also involved in the inflammatory process. There has been considerable hemorrhage and many pigmented cells which are indicative of it. There are no cells which indicate a tumor process.

The wound healed by primary union throughout. On a lessece was complicated by a severe attack of tonsillitis. On the eleventh day a fluctuant redness was noted at the low angle

occur there is usually rapid consolidation with a marked tendency to obliteration of the fibrocytic area. The radiograph is of the greatest aid, and taken in conjunction with the clinical history may often enable one to arrive at a reasonably certain diagnosis. The lesion is usually round or oval, may be trabeculated, is well defined, and without changes in the surrounding bone or periosteum. Occasionally the cortex is perforated, but if so there is no bone production beyond it.

In differentiation it is well to remember that a central *gumma* which may otherwise resemble a fibrocytic lesion usually though not always, shows periosteal deposit of bone, as is also usually the case with an isolated bone *abscess*. An isolated tuberculous process may be difficult to differentiate but it is frequently not oval or circular in outline as is the fibrocytic lesion, its outline is not so definite, and frequently the periosteum is perforated and there is a resulting tuberculous abscess. The differentiation from a central *sarcoma* is often difficult, but the fact that there is rarely if ever periosteal overgrowth, with spicules of bone showing in fibrocytic lesions, may be of help. Often diagnosis can only be arrived at after exploration. Radiographic examination of the entire skeleton must be carried out to eliminate multiple lesions.

Treatment should be conservative. In the event of a fracture through the lesion, the fracture should be treated as any fracture of the region involved. In a considerable proportion of cases the fibrocytic lesion will gradually disappear as a result of the trauma. If there is no fracture the lesion should be studied at intervals by means of the x-ray with the possibility of spontaneous healing in view. When the diagnosis is in doubt, when the lesion is progressive or shows no evidence of healing after a reasonable period of observation exploration should be undertaken. The diagnosis may be frequently made from inspection at the time of operation. It should, however, always be confirmed by the pathologic examination of material removed. The lesion according to Bloodgood may consist of a bone-shell without connective-tissue lining with a connective-tissue lining or the shell may be filled with a solid mass of fibrous tissue.

Figure 713 shows condition three months after Fig. 712 and six months after operation. Dr. Le Wald reports at this time "The bone shows marked filling in of bone salts, but the graft can still be made out." The patient, as you see, has a slight limp which can be corrected by an inner sole. Otherwise he appears to be in normal health.

**Discussion.**—The fibrocystic lesion in the femur of the patient whom I have presented to you illustrates a type of lesion which is particularly important from the standpoint of the surgeon. A discussion of bone-cysts in general would involve a review of a large part of the pathology of the morbid conditions in bone, and I shall limit myself to the particular type of lesion of which I have shown you an example today. I would refer those interested in a broader discussion of the subject to the numerous articles by Bloodgood and Barrie and others.

The etiologic factor in fibrocystic bone lesions is not known, but from the evidence adduced by various observers, notably Bloodgood and Barrie it seems reasonable to assume that the lesion is inflammatory. Trauma is given as a causative factor if that is the case, it would seem to serve merely in a contributory way or the condition would be much more frequently observed than it is. There is probably some relation between giant-cell tumor of the bone or hemorrhagic osteomyelitis and fibrocystic lesions of the bone. It is possible that they are different stages of the same process and that the fibrocystic lesion, as Barrie suggests, represents partial cure. The condition occurs most frequently in those under twenty though it may occur at any age. It is most frequently found in the femur, humerus, and tibia, though it has been found in practically every bone in the body. With few exceptions it does not involve the epiphysis.

Probably most frequently the condition is brought to light following a fracture at the site of the lesion. In those cases discovered by chance or investigated on account of the symptoms the history is usually of little or no pain. There may be local tenderness and possibly localized enlargement. If near a joint, there may be some limitation of motion. If fracture does

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FROM THE SURGICAL SERVICE OF THE NEW YORK SKIN AND CANCER HOSPITAL, SECOND DIVISION SERVICE OF DR. GEORGE H. SIEGEL

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### I. CASE OF EPITHELIOMA OF THE OUTER CANTHUS OF THE EYE.

### II. CASE FOR THIERSCH SKIN-GRAFTING.

**Case I.**—In discussing the treatment of epithelioma certain fundamental principles must be laid down.

In the first place, caustic paste may be used to treat epithelioma. This is dangerous because of the uncertainty as to the extent of destruction of the lesion, especially in the depth, and with it the possibility of stimulation of the cancer left untouched and with an increasing activity in growth. The malignancy of the tumor would in this way of course, be greatly increased. In this method also the opportunity of microscopic study of the lesion is lost, which is a marked disadvantage.

Second, radiotherapy may be employed. This method is uncertain and unreliable because one cannot be sure that there is 100 per cent. destruction of the epithelioma in every case, and if the destruction is not 100 per cent. if only 1 per cent. of cancer cells remain, then that 1 per cent. is sufficient to develop into a 100 per cent. lesion again. It is impossible to say beforehand if there are any ray-resistant cells present or not. If they are present the radiotherapy will not destroy the cancer 100 per cent. and although the lesion may appear healed and cured for a time the epithelioma will begin to grow again within the scar tissue and frequently be of a much more virulent variety than the original lesion. Many cases are on record which have been treated by radiotherapy in which there was a recurrence of the tumor.

The microscopic picture of the connective tissue in either case is identical. Involvement of the periosteum is suggestive of malignancy as is ossification within the lesion or beyond the periosteum. The giant-cell tumor shows the characteristic granulation tissue. Other conditions which may be encountered are chondroma and myxoma, the latter being very rare. Skeletal metastases of a malignant tumor of the soft parts, though usually clearly indicated in the history *must* be borne in mind. Echinococcus cyst of the bone has also been occasionally encountered.

When the diagnosis has been confirmed at operation, the cavity or cavities should be curedted out, the walls crushed in, and the wound closed without drainage. If possible, in suturing the muscles it is well to so introduce the sutures as to roll muscle tissue into any dead space that may result from the crushing in of the walls of the cyst. It does not seem necessary to swab out the cavities with phenol or other chemicals. In certain cases where the treatment outlined would if carried out thoroughly so weaken the bone as to make fracture probable, it is desirable to use an inlay bone-graft, either of the sliding variety or if this is not practicable, one removed from a sound tibia. Complete resection seems unnecessarily severe.

In the patient whom I have shown you I had to deal with a fibrocystic lesion which had apparently persisted for five years in spite of two fractures. Careful observation for ten months following the last fracture revealed no evidence of obliteration of the cystic cavities save immediately adjoining the line of fracture, and the appearance of the radiographs was such as to strongly suggest the possibility of a third fracture in the event of even slight trauma. The simple operation of cureting and crushing in the walls of the cavities if carried out thoroughly would have weakened the bone to such an extent as to render accidental fracture probable. Complete resection of the involved segment was discarded as unreasonably severe. The operation which I have detailed was undertaken as meeting the indications in this particular instance with the least danger to the patient.

alcohol sponge after the excision of the lesion. Thus, if these most important points in the cancer technic are constantly kept in mind, many cases of recurrence following surgical excision caused by cancer-cell implantation on the raw surfaces at the time of the first operation can be avoided. To sum up

1. Surgical excision is the safest treatment of epithelioma.
2. Cancer-cell implantation its chief danger can be avoided by proper cancer technic
  - (a) Covering of ulcerations.
  - (b) Never to use the forceps on tissue side which has been used on tumor side.
  - (c) To reboil every hemostat used on tumor side before using it again.
  - (d) To wipe scalpel and wound with alcohol sponge.
  - (e) To keep raw surfaces covered with compresses or towels during the progress of the operation.

In cancer surgery about the eyelids the indications are two-fold. First, the growth must be removed in a safe manner and second the excised region must be closed by plastic repair. The most important point is that the surgeon who excises the epithelioma must think of nothing else than the radical complete removal of the cancer no matter how large the defect or what shape defect he will be creating by so doing. He must never have in mind the thought of how he will close the large defect he is making as he might then not be radical enough and not excise sufficiently and safely thinking rather of a pretty plastic repair and although the repair may be beautiful and complete a recurrence a few months or years later for which he is to blame, because he was not radical enough at the time of the first operation, will then surely bring to naught all the fine plastic work he may have done. The surgeon must be Mr Jekyl while he is excising the cancerous lesion, and once having radically excised it, he may become Mr Hyde again and think about the plastic repair.

Having thus outlined the broad general principles of the treatment of epithelioma, one may proceed to their application in this concrete case before us this morning.

The third manner of treatment of epithelioma is by surgical excision. This is the method of choice. If it is possible to completely excise the tumor keeping as far from the deepest portion as from its lateral borders, then it is removed ~~as~~ <sup>as</sup> ~~lets~~ at one time a fundamental principle of cancer surgery. As Handley has shown that cancer is so often present within the fascial planes, it is necessary frequently to excise deeper and wider at the base than at the skin level of the tumor. Cancer is an "enemy" and the camp of the enemy must never be invaded, but must be completely surrounded on *all* sides. By surgical excision one can be as painstakingly certain to remove the deepest portion of the lesion, with a safe margin of healthy tissue beneath it, as one is sure to stay safely distant from the lateral borders. This can be done by a careful examination of the specimen by the surgeon immediately upon its excision, cutting through the growth, and examining *in the gross* if the excision has been complete and if there is a margin of safety on all sides of the tumor.

The danger of this method of surgical excision is the implantation of cancer-cells on the raw surfaces left behind. This can be practically entirely overcome by the use of what is called the "proper cancer technic." With this is meant that every ulcerating epithelioma must be most carefully protected by first carbonizing the ulceration with the actual cautery and then covering the ulceration with a piece of gauze held in place by mattress sutures, or if these sutures cannot be placed, the gauze may be fastened by clamping the skin edge of the lesion and the edge of the gauze with mosquito clamps as the excision progresses. This protects the ulcerations. The next point in the technic is never to use a forceps on the tissue side with which the tumor side has been handled as cancer-cells may adhere to the forceps and thus be implanted. Likewise a hemostat which has clamped a vessel on the tumor side must never be used again until it has been reboiled, and thus any adherent cancer-cell destroyed. The scalpel used should frequently be wiped with an alcohol sponge to destroy and remove any adherent cancer-cells. The wound may be wiped with an

become involved as yet, except for a very small area at the skin margin at the outer canthus.

This patient is being operated on under colonic anesthesia, which has been used with the greatest satisfaction at our hospital. There is no anesthetist with his apparatus to bother the surgeon and the operation can be done in comfort.

The cancer indications having been met, and the lesion radically excised by circular excision (Fig. 715) the problem of the reconstruction presents itself.

The eyelids, which have been cut across are retracted markedly toward the nasal side by the contraction of the cut pars palpebralis of the orbicularis oculi muscles. They are brought back in place by taking a 00 catgut suture only through the muscle at the outer border of the cut lids and suturing them to the remaining outer portion of the junction of the tarsal and bulbar conjunctiva (Fig. 716). This will temporarily hold the eyelids in place and permit the closure of the tarsal conjunctiva with interrupted subconjunctival sutures. This closes the conjunctival sac again, narrowing the palpebral fissure but permitting the flap repair to be entirely extraconjunctival. It is fortunate that not much of the conjunctiva was involved in the lesion as the repair can be done without narrowing the palpebral fissure so much as to be inconvenient to the patient.

The problem of reconstruction is met by means of a flap plastic repair (Fig. 717). The pedicle is above, the flap being taken from the cheek and the base of the pedicle is well above the line of the canthi. This is important, as the later contraction of the flap will tend to widen the palpebral fissure, which had been reduced in size and the level of the base of the pedicle being above the level of the canthi there will be the desired upward pull of the flap. It will also avoid incising the flap at the outer canthus to widen the palpebral fissure which is a very disagreeable procedure to have to do as the angular scar thus created at the outer canthus would cause rigidity, inability to close the eyelids, and a leakage of tears. The flap is sutured in place with interrupted fine black silk sutures (Fig. 718) and the remaining defect on the cheek from where the flap was

This patient, a man fifty-seven years old, has an ulcerating epithelioma of the outer canthus of the left eye (Fig. 714). The duration of the lesion is three years. For many years previously he had a wart at the same place, probably a congenital dermatosis, which he pinched off three years ago. It bled some at that time and then began to grow slowly. For the last six months it has been growing faster and two months ago began to ulcerate.



Fig. 714.—Photograph of patient showing ulcerating epithelioma of the outer canthus of the left eye.

He has had no treatment previous to entering the hospital and therefore the lesion has probably not been handled much. This is important, as it is known that frequent handling of malignant growths increases the malignancy and frequently spreads cancer cells along the lymphatic channels. The lesion is in this case situated at the outer canthus measures about  $\frac{1}{2}$  inch in diameter and, unfortunately has transgressed on to the upper and lower eyelids for almost  $\frac{1}{2}$  inch. Luckily the conjunctiva has not



Fig. 719.—Diagram shows defect on cheek decreased in size by bringing wound edges together and suturing them to the underlying fascia. The defect is then ready to receive the Thiersch's graft.



Fig. 718.—Diagram shows flap rotated in place with line interrupted black silk suture. The defect on the forehead is the area from which the flap was taken. Line D-F shows the base of flap.

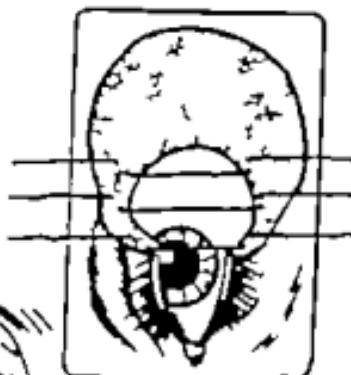


Fig. 717.—Diagram of pedicled flap rotated from cheek with pedicle above the pale forehead. Lines A-B-C is equal level of the canthus. Line D-E-F above the pedicle. Line D-F shows the largest curve of the flap to allow for the greater distance from point D to formed canthus. The shaded triangular area of skin must, of course, be excised to allow the flap to be sutured into place.



Fig. 715.—Diagram showing radical excision of the epiphelion, staying at  $\frac{1}{2}$  mm. distance from the lateral borders.

Fig. 716.—Diagram showing a large defect caused by excision of tumor with portion of upper and lower eyelids. Insert shows sutures placed suturectically for the preliminary repair and formation of new palpebral fissure, per rectus pedicle flap repair, i. e., extramconjunctival.



There are various methods of covering raw surfaces. One way is by means of Réverdin grafts. These are the so-called "pinch-grafts" in which small bits of epithelium are snipped off and transplanted to the raw surface. This type is used to advantage when the raw surface is infected and there is much secretion. In using these grafts the danger of their floating away is partially eliminated. The second variety are the Wolfe



Fig. 721.—Photograph of patient two weeks after operation showing narrowing of palpebral fissures.

or Girdner grafts. These are small bits of grafts similar to the Réverdin grafts, but the entire thickness of the skin is used. In this it is important to carefully trim off all the fat from the under surface of the graft. This point was especially brought out by Krause, who described the use of grafts similar to the Wolfe grafts, but much larger in size. Finally Thiensch described the use of 'graft shavings' of large size using only the outer layers

taken is reduced as much in size as safely possible by suturing the skin edge to the underlying fascia, and a small Thiersch graft is placed on the remaining defect (Fig. 719). This graft may be excised at the end of about four weeks, when the flap has become firmly adherent throughout, and the skin edges approximated by suture, leaving only a thin linear scar. The graft is dressed with silver foil and the suture line covered with wound shellac (Fig. 720).



Fig. 720.—Photograph of patient 11 weeks after operation showing pedicled flap in place, with a Thiersch graft covering the defect on the cheek.

All the fundamental cancer principles and indications have now been met in this case, and there is every reason to say that this patient will obtain a permanent cure of the epithelioma at the outer canthus of the eye (Fig. 721).

**Case II.**—This case has no especial clinical interest, since it presents merely a raw surface that requires covering with a skin-graft; but it affords an opportunity of discussing the question of Thiersch skin-grafting in some detail.

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of epithelium similar to Réverdin. And lastly there is the repair by pedicle flaps.

The raw surface must be dry and as sterile as possible. It may either be of very recent origin or it may be an older granulating wound. If the latter the character of the granulations for receiving the graft can be determined by putting on some gauze and making a little pressure. If the gauze, when carefully rolled off leaves its imprint on the granulations, then it is safe to assume that the transplanted grafts will hold and take. But if the imprint does not stay on the granulations, then they must be shaved off with a scalpel and pressure made with gauze



Fig. 722.—Diagram to show use of Birk angioma to crush seed, caught first by Halsted mosquito clamp. This technic does away with the ligatures least under Thiersch graft in certain cases.

to control and stop the oozing. It is well in these cases if possible to prepare the granulations the night before it is intended to graft. If there be much infection, iodoform gauze is best used for this purpose. When the raw surface is such as remains after the excision of a crural ulcer artificial anemia must be obtained by applying an Esmarch bandage at the thigh or a Sehrt metal tourniquet, and leaving it in place for three to four hours. This can be done with safety but the patient requires a big dose of morphin. After the compression around the thigh has been removed digital compression of the femoral artery at the pubic bone takes its place. It is slowly relaxed and the blood allowed to enter the field step by step.

When the raw surface is of very recent origin as following excision of a tumor or the defect caused by pedicle flap plastic, etc. then hemostasis is obtained by careful ligation of all bleeding vessels and pressure with a hot compress. If the area is in a region easily seen, as in the face, and the raised knot of the ligature would be unpleasant under the Thiersch graft, causing an irregular raised surface, then this may be overcome in some cases by clamping the vessel with a mosquito (Halsted) clamp and crushing the vessel on the tissue side of the clamp with a Blunk angiotribe (Fig. 722). This instrument is best used without the automatic catch (Fig. 723).

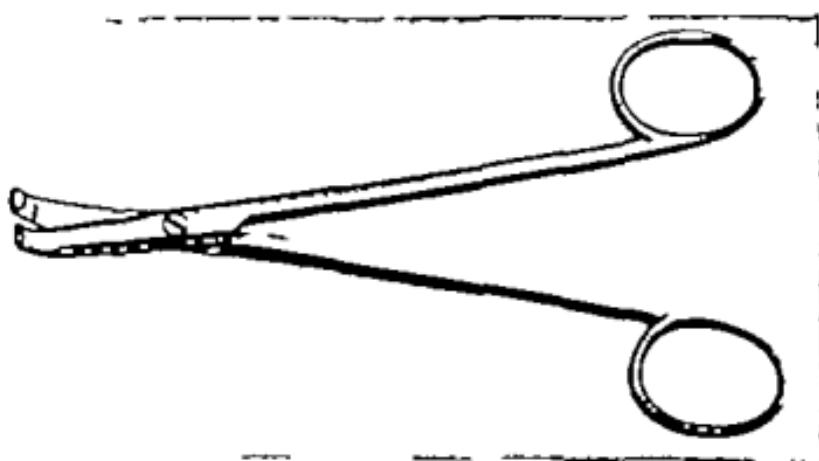


Fig. 723—Blunk angiotribe.

Besides good hemostasis the raw surface in recent wounds can usually be greatly reduced in size by undercutting the skin edges and drawing them together as much as possible and then suturing the skin edge to the underlying fascia. With the knots of the sutures on the skin side the sutures are left long and caught with a hemostat so as to be out of the way during the placing of the graft.

If possible the outer anterior region of the thigh is used to take the graft from at a level a little above the patella upward. This has been shaved and is cleansed with alcohol and ether. When the patient is not under a general anesthetic the best

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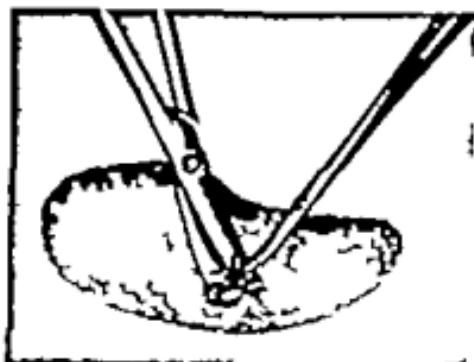


Fig. 722.—Diagram to show use of Black angiotraps to crush a clot, caught first by Halsted mosquito clamp. This technic does away with the ligature knot under Thiersch graft in certain cases.

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means of anesthetizing the area is by subcutaneous injection of  $\frac{1}{2}$  per cent. novocain solution. This is easily done through one needle puncture in fan-shaped fashion as shown in Fig. 724. A still larger area can be infiltrated through this same puncture by pushing the tissues with the left hand on to the already totally submerged needle (Fig. 725). The best syringe for this purpose is the Record syringe with bent tip and bayonet attachment for the needle (Fig. 726). The outer four corners of the area infiltrated are touched with a wipe moistened with tincture

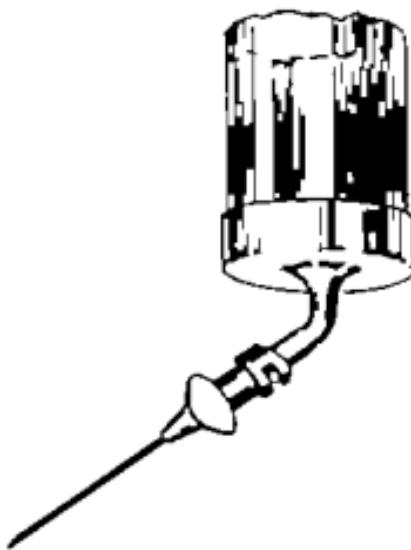


Fig. 726.—Record syringe with bent tip and bayonet lock for needle used for novocain infiltration.

of iodin, so as to mark the outer boundaries of the anesthetized area.

In cutting the graft it will be found to be very much easier to always cut from below upward (against the grain of the skin) than from above downward as the majority of surgeons are accustomed to doing. This procedure especially in some women and children with thin skin, prevents the annoying buckling of the skin (Fig. 727). The assistant must make very strong downward traction with his hand while the surgeon makes traction upward with his left hand. If this is done with the flat

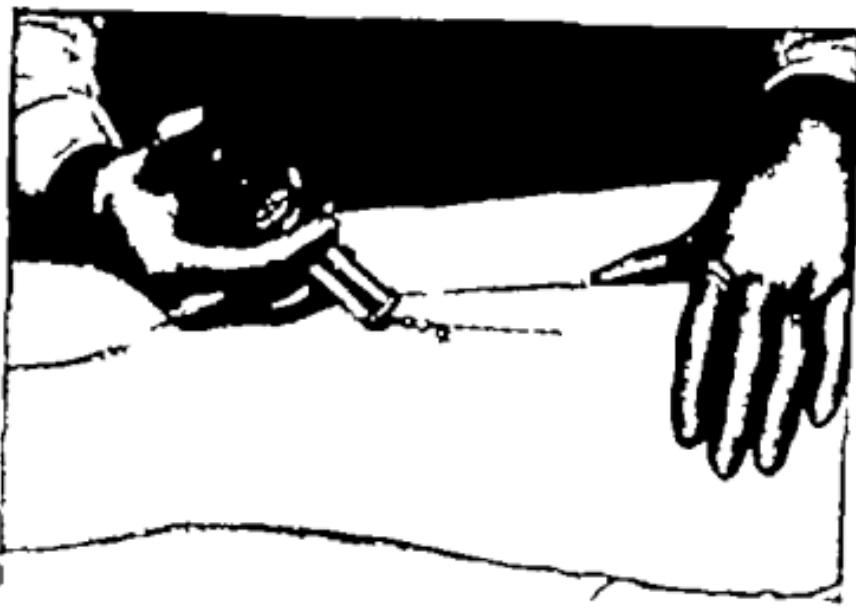


Fig. 724.—Shows how morocaine infiltration of thigh may be done through one needle passage. If long needle is fan-shaped fashion.

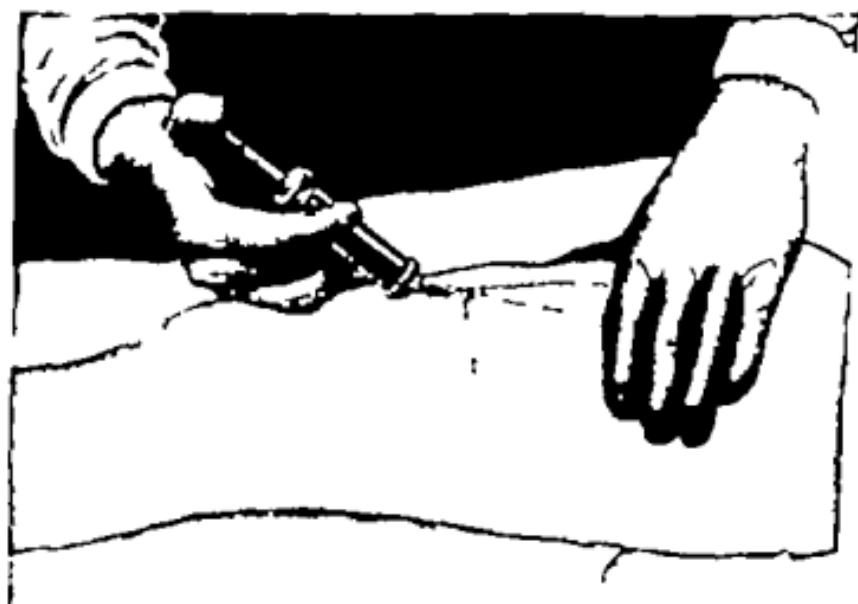


Fig. 725.—Indicates how still greater area may be infiltrated by pushing the tissues on to the already totally submerged needle with the left hand.

the aid of an assistant (Fig. 729). We have not employed this instrument and therefore cannot state its merits from experience with its use. After all the two hands, one of the assistant, and the other of the surgeon, are the very best means of fulfilling all requirements and conditions for putting the skin on stretch.

The field from which the graft is cut must be dry. The razor alone is moistened with saline and as soon as the graft



Fig. 721.—Shows how Thiersch graft shapes itself into triangular shaped graft, while being cut, by the surgeon curving his left hand as he slides over the skin while making traction upward, thereby causing the thigh to take on greater convexity and naturally narrower surface from which the graft is being cut.

has been cut the razor must be wiped dry so as to avoid NaCl corrosion of the edge. The small epithelial shreds are wiped off before the graft is transplanted on to the new surface.

In 1907 Max Hoffmann, of von Hacke's Clinic in Graz, Austria published a grafting razor constructed by him, which can be automatically set to cut grafts of a definite and equal thickness, depending on how close the rounded cross-bar is set

of the hand, which must be dry the skin will flatten out nicely and a good wide graft may be cut. If the thigh is very thin, a second assistant can push the soft parts from behind the thigh forward and thus obtain a wider surface from which to cut the graft. If the graft is to taper to a narrower point, more triangular in shape then, as it is being cut by the to-and-fro motion of the razor in the right hand, the left hand of the surgeon which makes the traction upward with the flat of the hand must slowly



Fig. 727.—Indicates how the Thiersch graft is cut from below upward, the assistant making strong traction downward toward the knee, while the surgeon makes traction upward with his left hand.

be curved (Fig. 728) thereby making a greater convexity of the skin of the thigh, and the graft will automatically shape itself.

Many mechanical means have been devised in the form of instruments to make this tension of the skin such as the grafting skin hooks of McBurney and lately T. P. Killor and T. Jackson in their article on Thiersch Skin-grafting in the Buccal Cavity (British Journal of Surgery July 1921) advise the use of an instrument for skin fixation in cutting a graft when alone without

transfer the graft directly from the razor. The raw surface of the graft may be distinguished from the external surface of the graft by its shiny appearance. Once on the denuded surface,

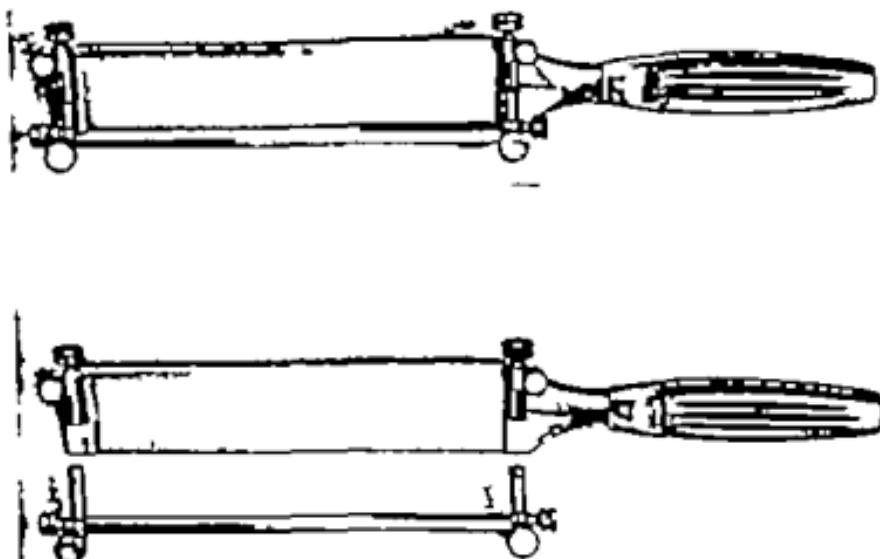


Fig. 730.—Hoffmann automatic grafting razor. The smooth rounded bar shown separately is the adjustable portion of the razor. The two pairs of set-screws regulate its distance from the razor edge. One set adjusts the distance above the razor edge to regulate the thickness of the graft, while the other adjusts the distance in front of the edge to allow for narrowing of the blade after sharpening.

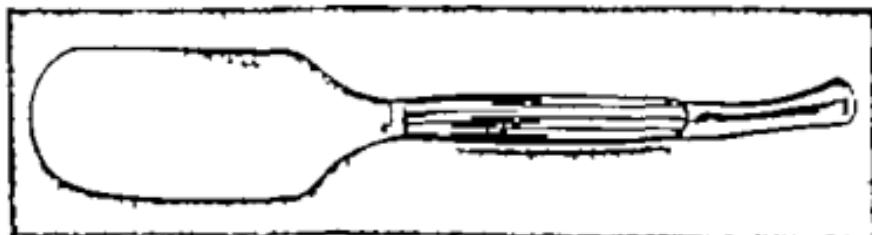


Fig. 731.—Grafting spoon on thick graft may be smoothed out before transferring it to raw surface. These may be had in various sizes.

the graft must be smoothed out. This is done by fixing it with the ball end of a probe and smoothing out the edges with the flat end of another probe. Air-bubbles can best be expelled by

above the edge of the razor. The width of the graft cut depends on the amount of pressure made on the skin by the rounded bar which flattens the skin out and allows the graft of a certain thickness to be cut even though marked pressure is made with the razor. As the razor blade is sharpened and becomes narrower with use the bar can be adjusted to always be the same distance away from the front edge of the blade. It is an ingenious instru-

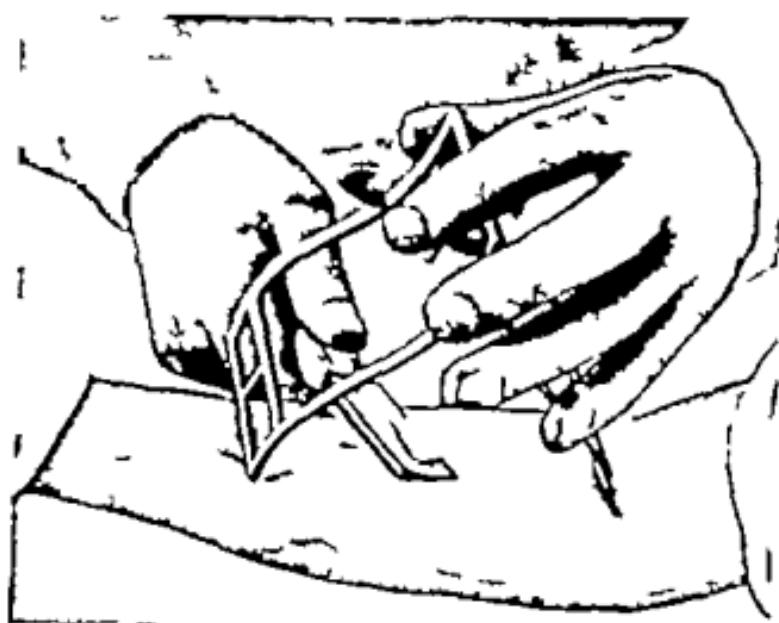


Fig. 729.—Automatic skin fixation instrument used in cutting graft without assistance as devised by T. P. Kiser and T. Jackson. (Taken from *British Journal of Surgery* p. 133, July 1921.)

ment and easily handled. It was described in the *Centralblatt für Chirurgie*, vol. 1907, p. 318 (Fig. 730).

The graft having been cut, the thigh is temporarily covered with moist gauze and the graft transferred from the razor directly to the raw surface. In some cases it is convenient and wise to first smooth out the graft on a grafting spoon (Fig. 731) from which it can be easily transferred to the raw surface by just holding the graft fixed with a probe and sliding the spoon out from under it (Fig. 732). Usually however it is easiest to

transfer the graft directly from the razor. The raw surface of the graft may be distinguished from the external surface of the graft by its shiny appearance. Once on the denuded surface,

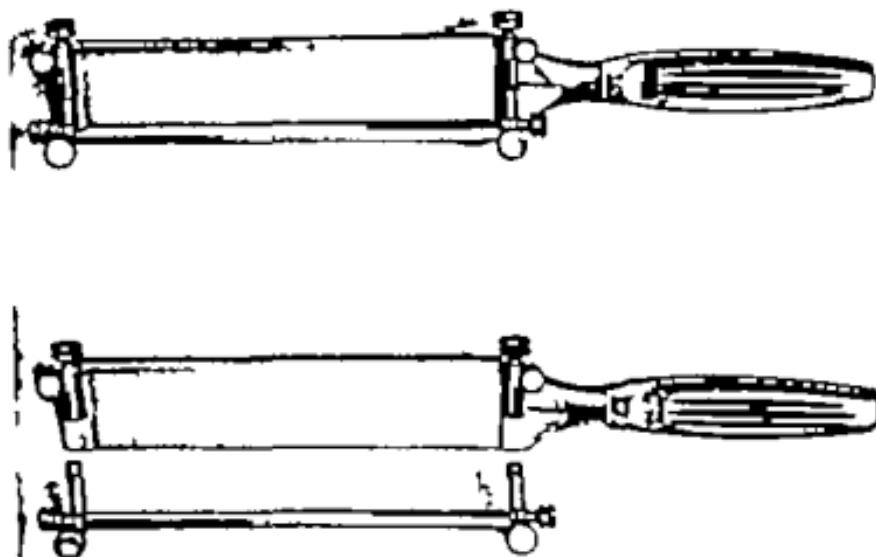


Fig. 730.—Hoffmann's automatic grafting razor. The smooth rounded bar shown separately is the adjustable portion of the razor. The two pairs of set-screws regulate its distance from the razor edge. One set adjusts the distance above the razor edge to regulate the thickness of the graft, while the other adjusts the distance in front of the edge to allow for narrowing of the blade after sharpening.

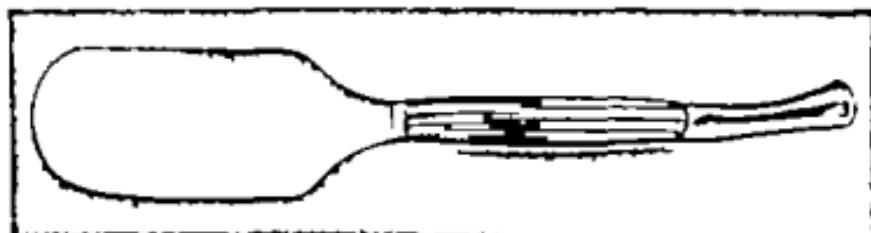


Fig. 731.—Grafting spoon on which graft may be smoothed out before transferring it to raw surface. These may be had in various sizes.

the graft must be smoothed out. This is done by fixing it with the ball end of a probe and smoothing out the edges with the flat end of another probe. Air-bubbles can best be expelled by

making pressure over the graft with a moist gauze compress. Being moist it will not adhere to the graft or dislodge it. Instruments with which the graft must be handled or trimmed must be moistened with saline or else the graft will adhere to them.

The graft should not always be placed directly up to the edge of the defect. This is especially the case when the surrounding border is raised. A little alley-way at the border allows oozing to escape without lifting the graft up and dislodging it. It also gives a smoother scar by pulling the raised edges down and prevents the circular contraction of the edge which takes place

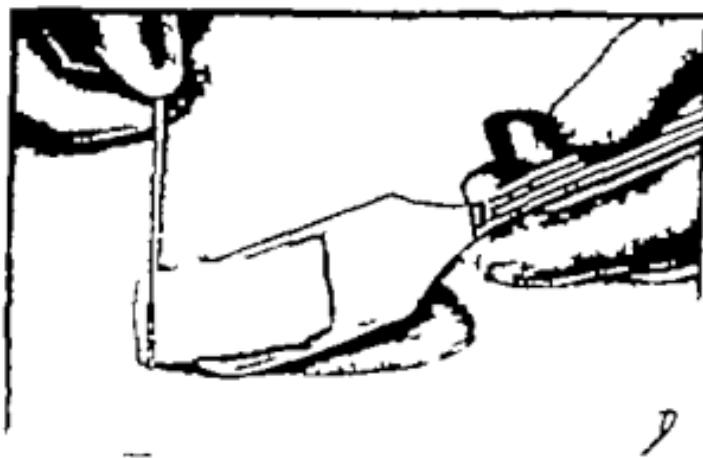


Fig. 732.—Diagram showing how the graft may be placed on defect by just lifting spoon from under graft.

when the graft is laid directly up to the border. This contraction is annoying as it causes an overhanging of the circular contraction ring onto the flat graft in the middle of the defect. It is most important to avoid defects between the edges of separate grafts as the graft at any rate has to fight for its existence, and therefore reproduction is in abeyance. If defect is present between grafts granulations spring up rapidly and it then sometimes takes from five to six weeks before these granulations will be covered with epithelium. Therefore any defect should be at the edge of the wound where the normal epithelium from the skin can advance to meet the graft.

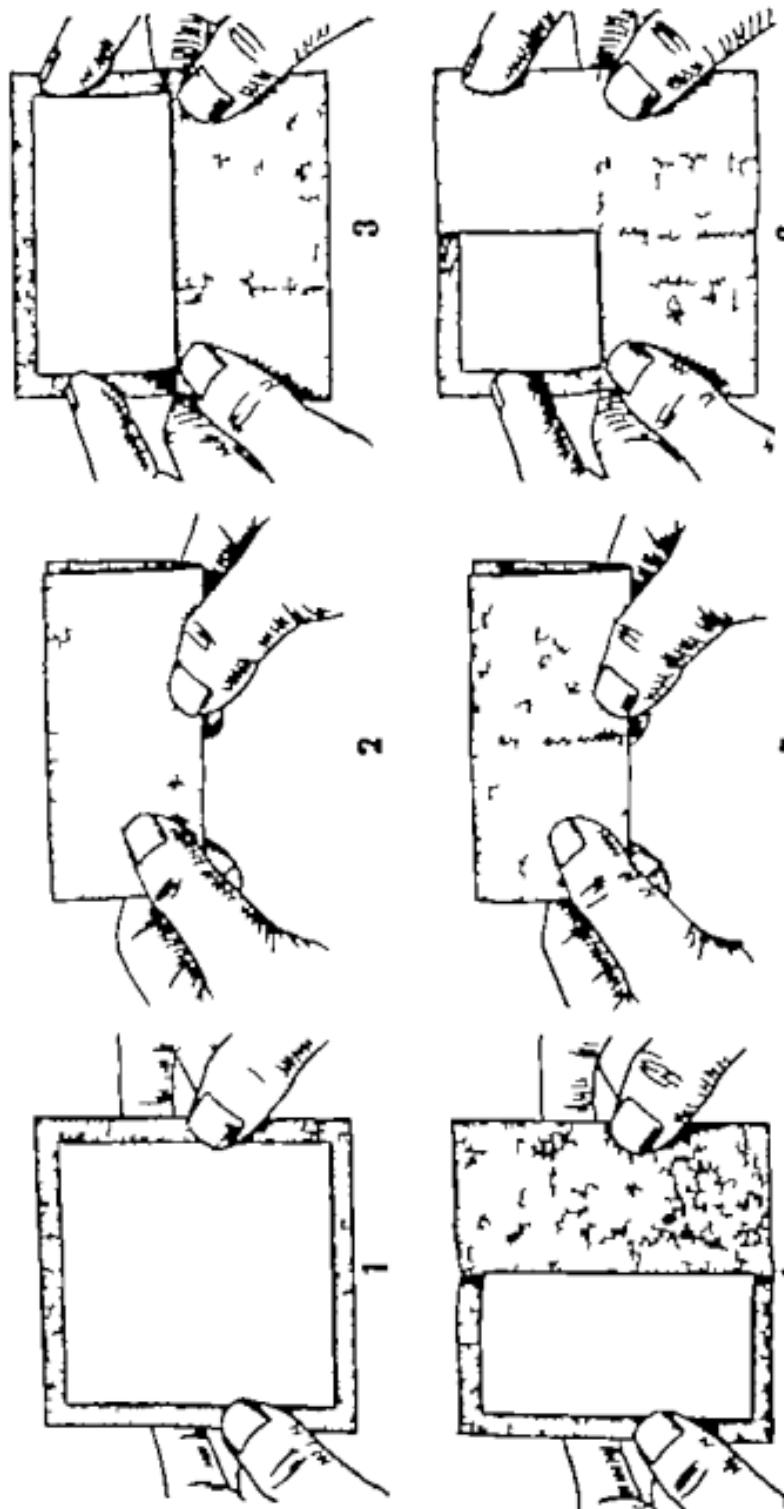


Fig. 711.—Diagram to show how the silver foil may be folded into any shape desired by folding the paper with the foil on it, over on itself. The paper above is then opened up completely before folding it into the next shape desired.

If there is much oozing of blood a little wider alley-way must be left and a thin narrow layer of Jodoform gauze laid over this alley-way.

The best dressing for these skin-grafts is the sterile silver foil. It forms a mechanical covering for the graft which, however, is so fragile that it will easily break and allow secretions to escape. The oxychlorids or oxids of the silver also have antiseptic properties and hinder the growth of bacteria. The graft is covered with from 5 to 7 layers of the silver foil while the wound on the thigh is covered with 10 to 14 layers of the foil. The operation being practically completed the surgeon's gloves may be removed and the hands thoroughly dried. With bare, but dry hands it is much easier to prepare and place the silver foil on the wound. Any slight moisture on the hands will make the foil adhere and cause no end of trouble and annoyance. The foil can easily be folded while still on the small paper squares into any shape and size desired by folding the paper over on to itself and thereby also the foil (Fig. 733). The only trick to remember is to completely open up the small paper before folding the foil anew.

The foil is covered with a thin layer of sterile gauze and this is firmly fixed with sterile zinc adhesive plaster not merely with transverse strips but also oblique ones, and over this the ordinary picture-frame strips are placed. If the black silk sutures used to decrease the size of the raw surface were left long they may be used to hold the dressing in place by tying them across the foil and gauze dressing.

One word about the after treatment. The dressing on the grafted area is left in place for five to seven days, when it is dressed with a bland bismuth and zinc ointment. Later if there are any areas not completely closed, a 1 per cent. fuchsin (Merck) ointment will best stimulate the growth of epithelium. The dressing on the thigh is left undisturbed for fourteen days, when it may be removed and the wound found completely healed.

## CLINIC OF DR. SEWARD ERDMAN

NEW YORK HOSPITAL

### HIGH ENTEROSTOMY FOR RELIEF OF ILEUS COMPLICATING APPENDICITIS

*Jejunostomy the Choice for Relief of Ileus Complicating Appendicitis, Whether Mechanical or Paralytic. Presentation of Three Cases. Indications. Results. Technic of Procedure. Inefficiency of Other Methods.*

TODAY I am confronted with the very unusual necessity of operating upon 2 cases of ileus complicating peritonitis from acute appendicitis, and afterward I will show you a third case from the same ward a man who is now convalescent.

**Case I.**—Jejunostomy for ileus on the third day after appendectomy for ruptured gangrenous appendix, with spreading peritonitis.

This patient, a Greek waiter aged thirty-four years, presents, as you see the picture of an advanced general peritonitis and is a desperately sick man.

The slender fæces are pinched and drawn the lips and tongue are desiccated, the breath foul and feculent in odor.

Vomiting has been persistent for over twenty four hours and colon irrigations return without gas or feces.

The vomiting or rather 'spitting' is really a regurgitation, and issues from the mouth without any effort at forcible vomiting.

The vomitus consists of small amounts of yellowish-brown fluid with a disagreeable odor but it can hardly be termed fecal, although it appears definitely to be intestinal in origin.

These cases are reported by courtesy of Dr. E. H. Pool Chief of Service Second Surgical Division, New York Hospital.

If there is much oozing of blood a little wider alley-way must be left and a thin narrow layer of iodoform gauze laid over this alley way.

The best dressing for these skin-grafts is the sterile silver foil. It forms a mechanical covering for the graft which, however is so fragile that it will easily break and allow secretions to escape. The oxychlorids or oxids of the silver also have antiseptic properties and hinder the growth of bacteria. The graft is covered with from 5 to 7 layers of the silver foil, while the wound on the thigh is covered with 10 to 14 layers of the foil. The operation being practically completed the surgeon's gloves may be removed and the hands thoroughly dried. With bare, but dry hands it is much easier to prepare and place the silver foil on the wound. Any slight moisture on the hands will make the foil adhere and cause no end of trouble and annoyance. The foil can easily be folded while still on the small paper squares into any shape and size desired by folding the paper over on to itself and thereby also the foil (Fig. 733). The only trick to remember is to completely open up the small paper before folding the foil anew.

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One word about the after treatment. The dressing on the grafted area is left in place for five to seven days, when it is dressed with a bland bismuth and zinc ointment. Later if there are any areas not completely closed a 1 per cent. fuchsin (Merck) ointment will best stimulate the growth of epithelium. The dressing on the thigh is left undisturbed for fourteen days, when it may be removed and the wound found completely healed.

with the symptoms of ileus, locking of the bowels, distention, and intestinal vomiting.

Whether the ileus is due only to paralysis or is mechanical or both, I believe it is impossible to distinguish.

Certainly the distressing vomiting and the distention demand relief if possible and we shall perform a high enterostomy as a

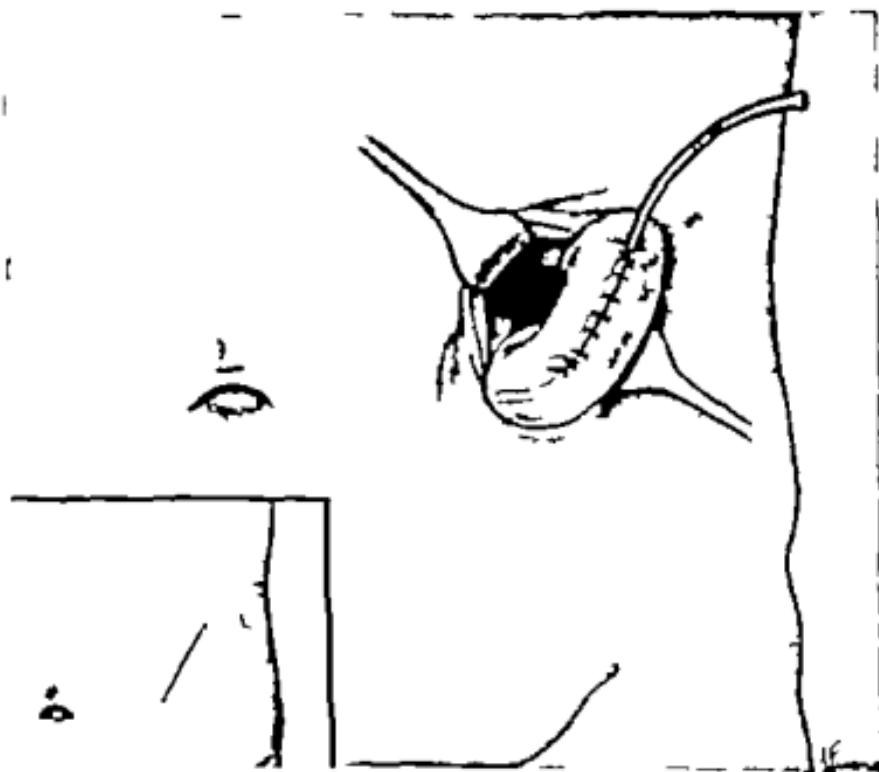


Fig. 734.—High enterostomy through intermuscular incision to outer border of left rectus.

dernier ressort in the attempt to drain the toxic material within the intestine, the absorption of which is but adding to the toxemia due to the peritonitis.

**Preparation**—Gastric lavage is always to be performed immediately before any operation for intestinal obstruction, and has been so performed in this case. Numerous cases have died on the operating table from neglect of this precaution.

The skin is moist, the hands cold and clammy

The temperature is 102° F and the pulse is small, thready and 144 per minute.

The abdomen is distended, tympanitic, but not rigid.

The open wound of the appendectomy is discharging a colon odored brownish pus.

*History*—On October 6 1921 he began to have steady colicky pain in the lower abdomen, with nausea but no vomiting. The pain became localized over the appendix and has been persistent. The bowels moved on the second and third days, but not since. On the third day dysuria supervened.

On October 10 1921 he was admitted to the New York Hospital with a temperature of 102° F leukocytes 16,000 88 per cent. polynuclear. At this time he presented rigidity of the right lower abdomen, with marked rebound tenderness over the entire abdomen.

A small mass was palpable in the region of the appendix.

*Operation* was at once performed by one of the surgical staff and a completely gangrenous appendix surrounded by 2 ounces of pus with the odor of colon bacillus, was found and the appendix removed. The peritoneum of the surrounding intestines was seen to be acutely inflamed. Two cigarette drains.

For two days following this operation the temperature remained elevated and the pulse became more rapid.

Abdominal distention became constantly more marked, and for the past thirty hours there has been vomiting at frequent intervals despite several lavages of the stomach.

Until this morning there had been no passage of gas or feces from the rectum but this morning, after a colon irrigation combined with the administration of pituitrin, a small amount of gas and feces was obtained.

Directly after this the distention recurred and the vomiting has been incessant.

Today the seventh day of illness and the third after operation, the man is almost in *extremis* with pulse of 144.

*Indications*.—Realizing that this man has undoubtedly a general septic pentoanth, we are nevertheless, face to face

with the symptoms of ileus, locking of the bowels, distention, and intestinal vomiting.

Whether the ileus is due only to paralysis or is mechanical, or both, I believe it is impossible to distinguish.

Certainly the distressing vomiting and the distention demand relief if possible and we shall perform a high enterostomy as a

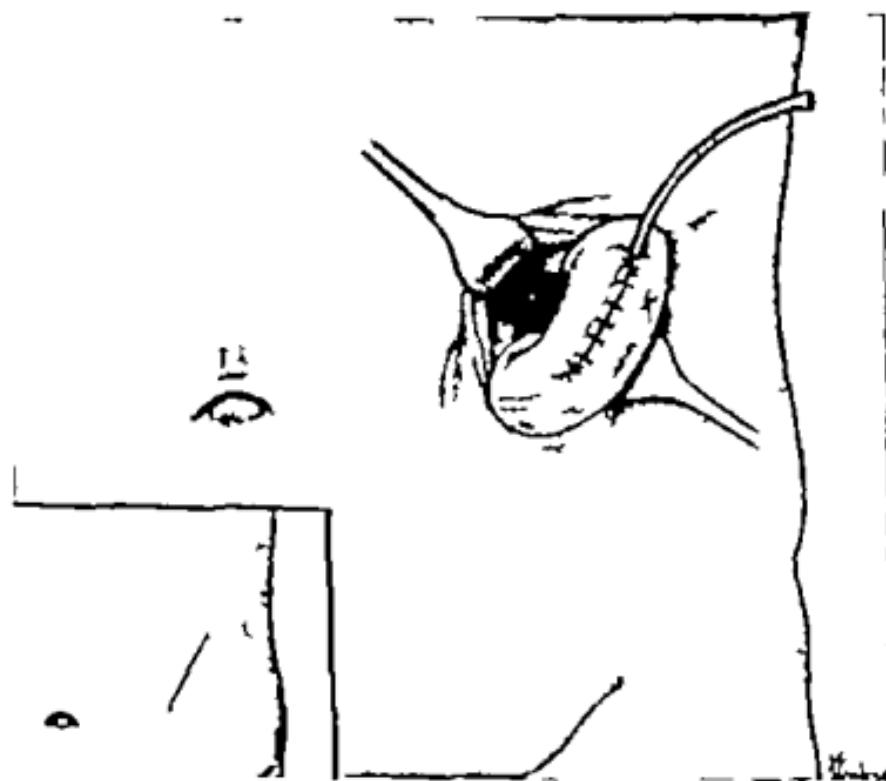


Fig. 734.—High enterostomy through intermuscular incision, at outer border of left rectus.

dernier ressort. In the attempt to drain the toxic material within the intestine the absorption of which is but adding to the toxæmia due to the peritonitis.

*Preparation.*—Gastric lavage is always to be performed immediately before any operation for intestinal obstruction, and has been so performed in this case. Numerous cases have died on the operating table from neglect of this precaution.

The aspiration of vomitus under a general anesthetic simply drowns the patient.

We do not intend to use a general anesthetic, but the lavage will render safer the addition of a general anesthetic if our local anesthesia proves unsatisfactory.

*Anesthetic.*—Local anesthesia with 1 per cent. novocain is to be preferred.

*Tecnic of High Enterotomy*—An oblique intermuscular incision is made in the left side of the abdomen just lateral to the left rectus and a little above the level of the umbilicus.

Upon opening the peritoneum I encounter a turbid free fluid from which a culture is taken. (Later reported colon bacillus.) The intestines are distended and very red but no lymph is seen.

Without trauma or unnecessary handling a short loop of distended intestine is drawn out of the incision.

On the convex surface a circular purse-string chromic suture is placed, the intestine opened with the thrust of a scalpel, a No. 20 French catheter rapidly introduced for 3 inches, and the purse-string suture at once tied snugly.

The end of the catheter has been previously cut off and a lateral opening made in it near the tip.

The tube is now depressed along the convex surface of the bowel, thus lying in a furrow and the edges of the furrow are sutured together over the tube for a longitudinal distance of 1½ inches, after the Witzel method of gastrostomy.

The intestine is now returned to the peritoneal cavity and sutured lightly to the peritoneum. The wound is not sutured, but the tube is fastened to a skin edge with silk.

A small rubber-dam drain is placed down to the peritoneum.

You see that we have obtained almost at once a gush of about 10 ounces of fluid intestinal contents through our tube, and of the same character as the vomitus.

*Appended History of Case 1*—Only small amounts of drainage were obtained in this case. The vomiting and distention were somewhat mitigated, but not entirely relieved, and the man died eighteen hours later. No autopsy could be made.

*Remarks*—It is possible that earlier enterostomy might have been of greater benefit.

**Case II.**—The next case for operation is Joseph S., aged eight years, who was admitted to the New York Hospital on October 4 1921 suffering from acute suppurative appendicitis with spreading peritonitis, the illness being then of four days duration.

*History*—One previous similar attack four months ago.

On October 1 1921 he was seized with general abdominal pain, becoming limited to the right lower quadrant.

There was vomiting with the onset, and on the third and fourth days he complained of difficulty in urination.

On admission to the hospital the temperature was 103° F the leukocytes 16,000 with 90 per cent. polymorphs.

On October 4th at operation, which was performed immediately a suppurative appendix was removed. The appendix lay surrounded by several ounces of purulent fluid (culture showed *colon bacillus*) its tip lay over the brim of the pelvis and to the left of the midline. There was practically no attempt at walling off and a spreading peritonitis was recognized.

*Drain.* Rubber-dam Mikulicz drain. Wound not sutured.

Following this operation the boy did not do well the abdomen became distended and each day he vomited several times.

Colon irrigations and catharsis alike failed to obtain satisfactory returns.

On the seventh postoperative day a pocket of pus, which had been felt by rectum, was opened into and drained through the appendix wound, and about 3 ounces of pus evacuated from deep in the pelvis.

For the past forty-eight hours, however the distention has become more marked the vomiting has become persistent, and there has been no passage of gas or feces.

The vomitus has become feculent in character.

*Present status* October 13th the thirteenth day of illness and the ninth day after appendectomy. You see an undersized, wasted little boy who appears very ill. The lips are dry and covered with sordes, the cheeks are sunken the tongue desiccated

and the breath foul. He is vomiting small amounts of dark brown watery fluid. The abdomen is very distended and tender over all. The appendix wound is draining a foul-smelling pus.

*Indications*—The whole course of the case points to a general peritonitis with a supervening ileus.

In this case the ileus may be suspected of having a mechanical origin, in view of the matting of the intestines about the drained abscess in pelvis; on the other hand, it may be purely paralytic.

In either case a high enterostomy seems definitely indicated.

*Procedure*—1. Lavage has just been performed in an adjacent room.

2. Anesthetic. On account of the youth and lack of co-operation of the patient we are here using ether by the open method instead of a local anesthetic.

3. We make a 1½-inch intermuscular incision 3 inches to the left of the midline and just above the level of the umbilicus.

As we open the peritoneum a small amount of turbid serum escapes, and the reddened, distended loops of intestine are flecked with plaques of lymph, indicating the generalized character of the peritonitis.

A distended loop of intestine is delivered and a jejunostomy performed as above described, using in this case a No. 18 French catheter with the end cut away.

The returned bowel is sutured to the peritoneum, the tube sutured to the skin, and the wound left open.

There has been a minimum of trauma and exposure of the bowel, the whole operation has taken less than ten minutes, very little ether has been necessary and there should be no appreciable shock to the patient.

While the dressings are being applied you see that we have already collected more than 10 ounces of brown intestinal fluid similar to the recent vomitus.

*Appended History of Case II*—The enterostomy tube drained very satisfactorily into a bottle beside the bed for four days, yielding 20, 16, 10 and 6 ounces respectively.

The vomiting never recurred after operation, and the distention was rapidly and markedly relieved.

On the fourth day gas and feces passed by rectum the tube was removed there was slight leakage for five days, after which the wound closed.

General improvement was immediate and the boy was discharged cured on November 9 1921

**Case III.—Appendix abscess, ruptured. Spreading peritonitis. Ileus. High enterostomy. Recovery**

We wish to show you a third case of high enterostomy one which is now convalescent in our wards.

**History**—K. E. A. a Swedish barber aged sixty years, was admitted to the New York Hospital on September 23 1921 with symptoms of intestinal obstruction, complicating ruptured appendix abscess.

For two weeks he had been sick in bed at home. The onset was with general abdominal pain, nausea and diarrhea.

After the first day the pain became localized in the right lower quadrant and remained there for six days.

Five days before admission to the hospital although the local pain was less and he had not vomited since the second day of the attack, the vomiting returned, and has been persistent up to the present.

His physician says that the vomitus has become definitely fecal and for the past thirty-six hours he has passed no gas or feces.

**Condition on Admission**—An elderly poorly nourished man, markedly prostrated, appearing so desperately ill that he seems almost moribund.

Lips and skin dry tongue heavily coated, dry breath of foul, fecaloid odor Vomitus of fecal character

The respirations were rapid, labored and shallow

The pulse was feeble and thready

The abdomen was much distended and rigid with general tenderness maximum in the right lower quadrant.

His physician reported that several days ago there had been palpable a mass in the appendix region, but at present the tenderness and rigidity entirely masked palpation.

The temperature was 102° F. The leukocytes 27,000 88 per cent. polynuclear.

*Indications*—The outstanding feature in this case, as I saw the man on admission, was the ileus, which urgently demanded relief.

*Procedure*—1. Gastric lavage returned, with a large amount of fecal smelling brown fluid.

2. Anesthesia. To shorten the time consumed in making two incisions gas-oxygen anesthesia was administered.

3. (a) An intermuscular incision was made over the appendix and an abscess about the cecum containing 2 ounces of thick creamy odorless pus was evacuated.

The appendix was not palpable and was not sought for.

A large rubber-dam Millulles tampon drain was inserted and the wound left open.

(b) Recognizing the serious import of the ileus, whether paralytic or mechanical an immediate enterostomy seemed indicated, in addition to draining the appendix abscess.

Accordingly an intermuscular incision was made 4 inches to the left of the umbilicus and a high enterostomy performed with the usual technic, using a tube the size of a No. 18 French catheter. The wound was left without suture.

In this left upper quadrant there was free turbid fluid and the distended intestines were very red.

4. The entire procedure occupied twenty minutes. Before leaving the operating table more than 700 c.c. of foul-smelling fluid feces and considerable flatus were expelled through the tube.

*Postoperative Notes*—For three days there was profuse drainage averaging about 1500 c.c. per day.

On the second day and for four days thereafter there were small involuntary liquid stools.

The tube was removed on the fourth day after which there was scarcely any drainage for the valve action of the enterostomy opening came into play and the wound healed very promptly.

After the operation the distention was once relieved and there was absolutely no recurrence of the vomiting.

The convalescence has been rapid despite a fecal fistula in

the appendix wound, which discharged from the fourth to the seventeenth day.

*Addenda.*—This third case was discharged on October 18, 1921.

#### HIGH ENTEROSTOMY

Neither this method nor any other will save all cases but as a valuable and efficient method of bowel drainage it has much to be said for it.

Credit for the idea of "high" as opposed to "low" enterostomy belongs to Victor Bonney of the Middlesex Hospital in London, who proposed the high enterostomy for intestinal obstruction in 1910.

For more than half a century the practice of enterostomy has usually followed the suggestions of Netton, that through a right lower quadrant incision the "first coil of distended intestine which presents should be sutured in the wound and opened. In effect this usually drained the lower ileum.

In our own experience, and we believe in the experience of surgeons generally the results have been far from satisfactory not alone that the mortality has remained so high (for this will doubtless always remain high in the advanced peritonitic cases) but especially in that the attempted drainage so often failed to drain.

Following a low enterostomy one is accustomed to witness the exit of a considerable amount of flatus, and but very little or no fluid material.

There is collapse of the immediate segment of the bowel, but failure to relieve the general distention or to stop the vomiting.

In too many cases there is practically no further drainage of gas or feces, and one feels that little has been accomplished.

Recognizing the inefficiency of low drainage other more drastic measures have been recommended such as the exposure of multiple loops of intestine and the performance of multiple punctures or enterostomies, or the insertion of a rather stiff rubber tube which is threaded way up or down the bowel, by hauling the intestine on to the tube.

This sounds like a very shocking procedure involving the extensive handling of the intestines, and it is difficult to conceive of a desperately ill patient withstanding the operation.

**Rationale of High Enterostomy**—Bonney divided the intestine of obstruction cases into three segments

- (a) The lower segment, more or less collapsed which, however often contains some gas.
- (b) The middle containing gas.
- (c) The upper containing fluid and representing the zone of toxicity."

As soon as feculent or intestinal vomitus appears it shows that the upper fluid segment has reached the stomach, and therefore a jejunostomy will efficiently tap the toxic fluid level.

The peristalsis has become reversed, and Bonney explains the toxicity by asserting that "this upward extension of the limits of the fluid-containing segment is due to a rapid upwardly extending infection of the canal by organisms of the lower intestine.

Certainly toxic absorption from the mucosa must play a large part in the mortality from intestinal obstruction, and drainage of this fluid is a great desideratum.

**Conclusions**.—From a limited experience I feel confident that much more efficient drainage of the toxic intestinal contents can be obtained by a high enterostomy than by a low enterostomy.

The relief of vomiting and distention is greater after a jejunostomy than after a low ileostomy.

It is performed rapidly with a minimum of trauma, under a local anesthetic, and should cause no appreciable shock.

The valve-like action of a properly performed jejunostomy results in automatic closure of the opening as soon as the tube is removed and no secondary operation for closure is necessary.

After primary relief of obstruction the tube may be used for the ingestion of fluids.

There is no panacea for intestinal obstruction, but a "high enterostomy" is deserving of a very thorough trial.

## VARIX IN SCARPA'S TRIANGLE SIMULATING FEMORAL HERNIA

### Varix in Scarpa's Triangle. Symptoms. Physical Signs. Differential Diagnosis. Treatment.

THIS morning we are about to operate upon a patient who was referred to the hospital with the diagnosis of femoral hernia. Certain features in this case have raised in our minds doubt as to the correctness of the "hernia" diagnosis, and have led us to the diagnosis of varix of the internal saphenous vein in Scarpa's triangle.

*Case 1.*—The patient, Cecilia W., is a young Austrian woman aged twenty three years, a bookkeeper by occupation.

She was referred to the New York Hospital on May 13 1921 with the diagnosis of femoral hernia.

*Chief Complaint*—A swelling in the right groin.

*Present Illness*—About two months ago she casually noticed a swelling in the right groin, which has been slowly increasing in size, but which is not painful or tender.

*Past History*—For ten years she has had moderately varicose veins in both legs below the knees, which have not given rise to symptoms.

For two years there has been some gastric indigestion associated with marked constipation.

There is no history of typhoid or any other serious illness.

The menstrual history is normal. No pregnancies.

*Examination*—Just below the fold of the right groin there is visible and palpable a swelling or bulge about 1 inch in diameter. This is very prominent on standing and disappears on lying down. It is felt as a soft, almost gaseous, rounded mass, just lateral to the spine of the pubis and below Poupart's ligament.

These cases are reported by courtesy of Dr. E. H. Pool, Chief of Service Second Surgical Division, New York Hospital.

Through the overlying skin there is noted a faint bluish tinge.

There is definite expansile impulse on coughing but no contents are palpable.

Although readily reducible by light pressure, it rapidly reappears.

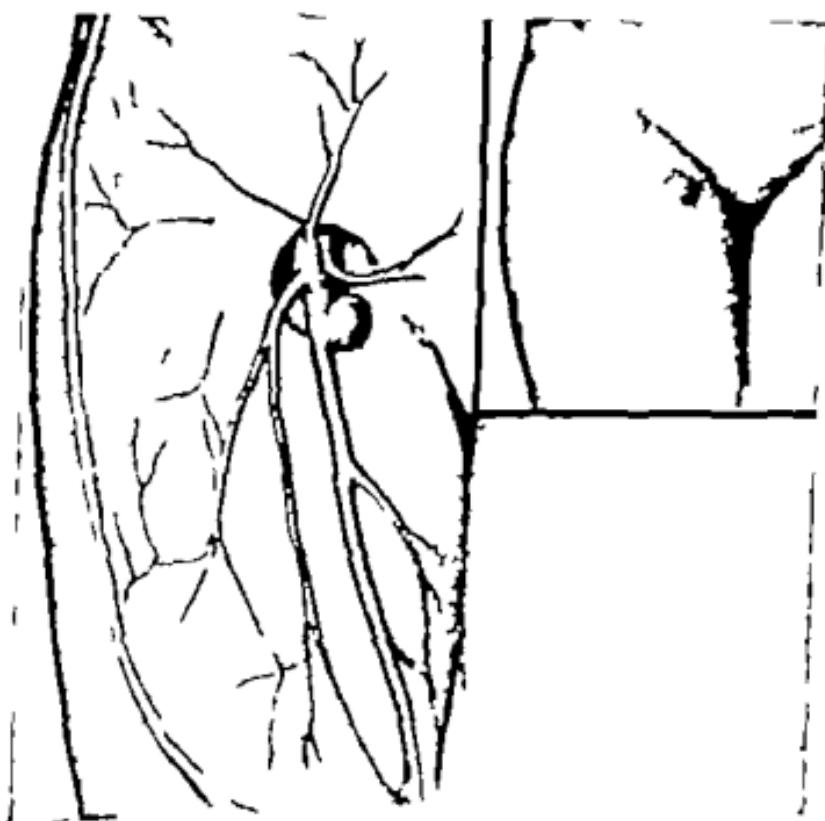


Fig. 735.—Varix of saphenous vein in Scarsa's triangle, associating femoral artery.

**Operation.**—We make an oblique incision below and parallel to Poopart's ligament, and as we divide the subcutaneous tissues we expose to view a rounded bluish mass, 1 inch in diameter situated superficial to the deep fascia and close to the saphenous opening.

Careful dissection shows this to be a thin-walled varix,

arising from the internal saphenous vein just before its junction with the femoral vein.

The shape of the varix is similar to a saccular aneurysm and is not a fusiform expansion of the whole vein.

We now proceed to excise the varix together with 1½ inches of the saphenous vein after the application of ligatures above and below.

Two other similar cases have been operated upon by me in the past year and I will present them at this time.

**Case II.**—Elizabeth B., an Irish woman aged forty, was in the New York Hospital from January 5 to 15, 1920, having been referred with the diagnosis of femoral hernia.

**Chief Complaint.**—Swelling in the right groin of seven weeks' duration.

**Present Illness.**—About seven weeks ago while bathing she noticed for the first time a swelling in the right groin, and she says that this has increased in size. It is not painful and it disappears upon lying down.

**Past History.**—Patient attributes the appearance of this swelling to heavy lifting in the course of her housework.

There is no history of serious or chronic illness, except that for some years the veins of both legs have been somewhat enlarged, but have caused no discomfort.

**Physical examination.**—The local condition showed a small swelling just below Poupart's ligament on the right side which was soft, compressible, and not tender.

There was expulsive impulse on coughing and at the same time a peculiar thrill, the direction of which was hard to determine.

The femoral ring did not feel enlarged. The skin over the swelling showed no change in appearance.

Both legs show slightly varicose veins.

**Operation.**—The usual oblique incision was employed and the dissection deepened to expose the saphenous opening.

A thin-walled bluish sac was seen arising from the superficial aspect of the internal saphenous vein just before it penetrated the cribiform fascia.

Search of the femoral region failed to reveal any sign of a hernia.

The varix was excised by removing 1½ inches of the saphenous vein between ligatures.

**Case III.**—Mary C., a Russian married woman of twenty seven years, was admitted to the New York Hospital on October 18, 1920 with the diagnosis of left femoral hernia.

**Chief Complaint**—Swelling in the left groin and pain which radiated over the pubis.

**Present Illness**—Five months before, she had noted a swelling in the left groin which increased slowly in size.

There is pain in this area, radiating to the pubis and often running downward toward the knee. The lump disappears on lying down.

**Past History**—No significant facts were elicited except that she had had three normal confinements. No illnesses and no operations.

**Physical Examination** on admission revealed an easily reducible swelling in the left groin, disappearing on lying down.

In the erect posture light pressure served to obliterate it, but it promptly returned to its former size without the aid of coughing or other increase of intra-abdominal pressure.

There is definite impulse on coughing, but no contents can be felt, nor is any thrill noted.

The swelling is just below Poupart's ligament and lateral to the pubic spine.

The superficial veins of both legs are slightly prominent, but this had not been noticed by the patient.

**Operations**—Incision and dissection below Poupart's ligament exposed a mass of distended tortuous veins, resembling somewhat the appearance of varicose

These veins lay superficial to the deep fascia and were shown to be derived from the superficial external pudic vein before its junction with the internal saphenous vein.

The mass of veins were excised after multiple ligations. The internal saphenous vein appeared normal and was not ligated.

There was no weakness in the region of the femoral ring and canal.

**Discussion.**—These 3 cases serve to illustrate the possibility of confusing a varix in Scarpa's triangle with femoral hernia, and it must be admitted that such an error may readily be made.

Indeed each of the cases above cited was referred to the hospital under an erroneous diagnosis of 'hernia.'

In the earliest case of the three (Case II) the correct diagnosis was made only at operation, but, profiting by this experience, we were enabled to arrive at the accurate diagnosis of varix in Cases I and III after careful weighing of the clinical findings.

**Diagnosis.**—In no one of these cases did the history furnish any definite clue to the diagnosis.

In each case there were noted slight varicosities of the veins of the legs below the knees, and although such a condition may exist in conjunction with a true femoral hernia, it should be given much consideration in arriving at the diagnosis, for it would naturally be expected as a concomitant in cases of varix in Scarpa's triangle.

**Differential Diagnosis from Femoral Hernia.**—**1. Site.**—The position of the swelling is almost identical, but in varix it lies usually definitely below and separable from Poupart's Ligament, and there is no upward extending neck or stalk.

**2. Reducibility.**—This is very easy and complete in varix, whereas in hernia it is usually only partial and often entirely impossible.

In the erect posture pressure will reduce a varix, but it rapidly resumes its original size without the aid of coughing or otherwise increasing intra-abdominal pressure.

**3. Consistency.**—In varix the tumor is soft, almost gaseous in consistency and no contents can be felt, whereas in hernia one may commonly feel the resistance of incarcerated omentum or other viscera.

**4. Thrill.**—In 2 of our cases a thrill was felt in the tumor on coughing but this is not to be considered an important point, because it is usual to feel a thrill in the femoral vein when examining the femoral region, even in normal individuals.

5. *Color*.—In a thin-skinned individual a bluish hue over the tumor would be in favor of varix. (See Case I.)

6. *Varicose Veins of the Legs*.—The presence of such a condition is not pathognomonic of varix, but should always be given due consideration and weight.

Conclusion.—Varix of the internal saphenous vein or its tributaries in the region of Scrofa's triangle may be readily confused with femoral hernia, but we believe that a painstaking examination, bearing in mind the differential points above mentioned, should in most cases establish the correct diagnosis.

## CLINIC OF DR. HAROLD NEUHOF

BELLEVUE, MOUNT SINAI AND MONTEFIORE HOSPITALS

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*Introduction.*—In selecting these cases for presentation my purpose is 1 To illustrate the difficulties sometimes encountered in the diagnosis of the existence, situation and nature of a spinal cord tumor 2 The description of a new method for localizing spinal cord neoplasia 3 The relief of intractable pain from a cervical tumor by high cervical division of the anterolateral tract. 4 Technical problems and problems in interpretation at operation. I shall make only brief mention of the essential neurologic manifestations presenting in the various cases

### INTRADURAL ENCAPSULATED METASTATIC ADENOCARCINOMA ATTACHED TO CERVICAL CORD

Severe Pain Localization of Neoplasm by a New Method Air Roentgenography Laminectomy and Subcapsular Removal of Tumor Without Relief from Pain. Second Operation Section of Anterolateral Tract at Third Cervical Segment, with Complete Relief Incision of the Spinal Cord Through the Fibers Carrying Sensation of Pain and Temperature is Devoid of Pain.

Mrs. S forty years old was admitted to Bellevue Hospital six years after a radical amputation of the breast for adenocarcinoma had been performed. About two years before admission she began to have pain in the right arm, later radiating from the right shoulder to the back of the neck and head. In the last six months the pain has become progressively more severe. Some time after the onset of pain weakness in the lower limbs was noted, more marked on the right side. The

5. *Color*.—In a thin-skinned individual a bluish hue over the tumor would be in favor of varix. (See Case I.)

6. *Varicose Veins of the Legs*.—The presence of such a condition is not pathognomonic of varix but should always be given due consideration and weight.

Conclusion.—Varix of the internal saphenous vein or its tributaries in the region of Scarpa's triangle may be readily confused with femoral hernia, but we believe that a painstaking examination, bearing in mind the differential points above mentioned, should in most cases establish the correct diagnosis.

skull without any evidence of irritation of the cord. I therefore concluded that it would be reasonably safe to withdraw spinal fluid and replace it by equal quantities of air with the expecta-

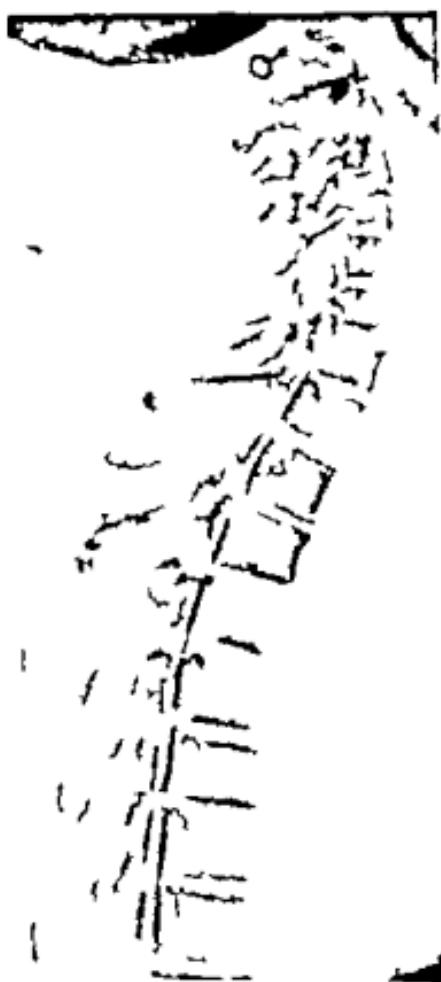


Fig. 736.—Reconstruction from ray pictures to show air column over rounding cord and stopping in lower cervical region to become trabeculated there in the neighborhood of the tumor.

tion that the air would be blocked and not flow freely above the situation of the tumor. This proved to be the case in this patient.

Three weeks after admission to the hospital the patient was

patient has been bed-ridden for several months, partly from the severity of the pain, partly from weakness in the lower extremities. Shortly before her admission she first noticed vesical urgency.

I shall not detail the neurologic manifestations. Suffice it to say that there was a suggestion of a Brown-Séquard syndrome, the right side preponderantly motor and the left side sensory. At no time could a sensory level be found referable to a lesion of the lower cervical cord. This held true at repeated examinations. The head was held stiffly. There was slight inequality of the pupils.

The provisional diagnosis was a spinal metastasis pressing upon the right half of the cord somewhere in the cervical region. It was anticipated that the x-ray examination would outline the lesion clearly in this region, particularly in such a thin individual, but the x-ray was entirely negative. Pictures taken of the head, chest, and extremities to determine the existence of metastases were also negative. The question arose as to whether we were dealing with a spinal metastasis or some other form of tumor that had happened to develop in a patient who had had carcinoma of the breast. This could not be decisively answered, of course, but in favor of the latter was a totally negative x-ray of the spine and examination elsewhere for the presence of metastasis. It was therefore concluded that an exploratory laminectomy was justified, and that without waiting for a well-defined sensory level.

The question arose what other methods could be employed to aid in the localization of this neoplasm. Some years ago I had shown that the subdural space in animals could be clearly outlined by collargol introduced through lumbar puncture and that in these experiments an impairment upon the dural space (by a mass artificially introduced) would block the flow of collargol and that the block would show up in the x-ray. It was realized that collargol would be too irritating for this purpose in the human being and, therefore I was led to the use of thorotrast. This also proved too irritating. In some of Dandy's work air was introduced intraspinally and permitted to flow up at the

vators. At first an attempt was made to separate the neoplasm from the spinal cord, but the relations were so intimate that this was discontinued. Then the lower pole was slowly dislodged and peeling carried out away from the cord. The growth was split in two in order to remove it with minimal injury the posterior half being shelled away first, and then the anterior more deeply seated portion. No visible injury was done to the

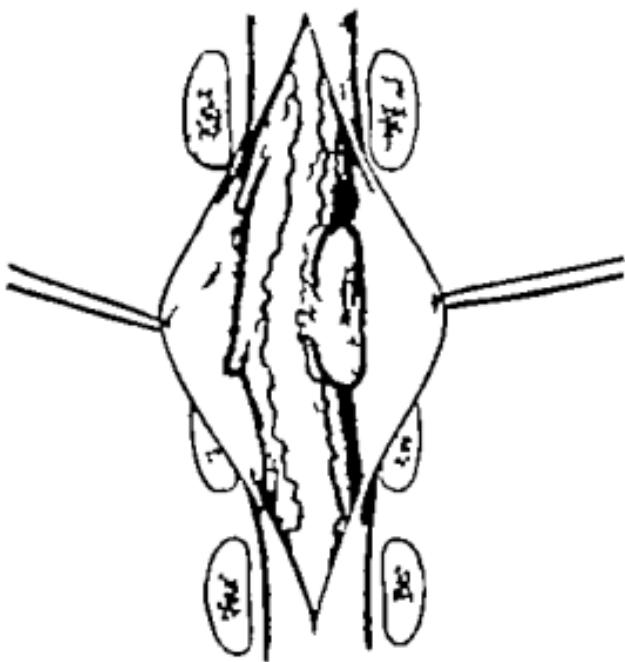


Fig. 737.—Appearance of the well circumscribed tumor upon opening the dura. Note its intimate attachment to the cord.

cord. Except for the possibility that the bed of the tumor in the spinal cord presented slight infiltration the tumor seemed to have been radically removed. At the end of operation the inner surface of the dura was perfectly smooth and appeared free from any evidence of tumor. Toward the close of operation the cord was beginning to shift back toward its medial position. The wound was closed in layers in the usual manner and a posterior molded splint was made to fix the head and neck on the shoulders.

taken to the x Ray Department, a lumbar puncture needle inserted to which a two-way stop-cock and syringe were attached. In 10 c.c. amounts about 50 c.c. of spinal fluid were withdrawn, and the same amount of air introduced into the canal without pressure. The pelvis was then elevated to avoid, as far as possible, the flow of air into the cranium. The x-ray pictures were taken in this position and the patient kept in bed in a similar position for two days. The only complication from this procedure was nausea and vomiting and some headache which cleared up in twenty-four hours.

The x-ray plates showed what might be described as a double vertical column of air outlining the spinal cord uniform in the lumbar and dorsal region, but trabeculated and apparently stopping opposite the sixth cervical vertebra. With this finding, operation in the lower cervical region was decided upon.

**Operation.**—The spines and laminae of the fourth, fifth, and sixth cervical vertebrae and subsequently those of the third were removed in typical fashion. Tension sutures were passed through the dura and an incision was made between them. There escaped a large quantity of cerebrospinal fluid, and the tumor was immediately exposed, lying to the right of the cord and pressing it far over to the left side. The neoplasm was about 3 cm long and 2 to 3 cm in the other axes. It lay opposite the laminae of the fourth and fifth cervical vertebrae, the poles somewhat overlapping these levels. Overlying the tumor were some thin trabeculations of the pia-arachnoid only loosely attached. Several fine branches of the posterior spinal vessels entered the neoplasm. It was grayish-pink in color and fleshy in consistency, well circumscribed, and encapsulated. The growth or its capsule was intimately attached to the adjacent surface of the cord, in hollow of which it lay. However no actual involvement of the cord by the growth could be demonstrated. The inner surface of the dura was free from any involvement, smooth after the removal of the tumor and presented no evidence that the growth was one which extended from the surrounding bone into the dura. The separation of the tumor from the spinal cord was slowly carried out with delicate ele-

the denticulate ligament beneath it. The latter was divided, caught with forceps, and used as a tractor to rotate the cord. This proved to be unsatisfactory perhaps because the cord was fixed below at the site of tumor removal. In order to expose this region adequately it was necessary to split the dura laterally on the left side. The cord was then lifted gently with a blunt strabismus hook to expose the third anterior root as a guide to the situation of the anterolateral tracts. With a von Graefe knife a rectangular incision was made across the left aspect

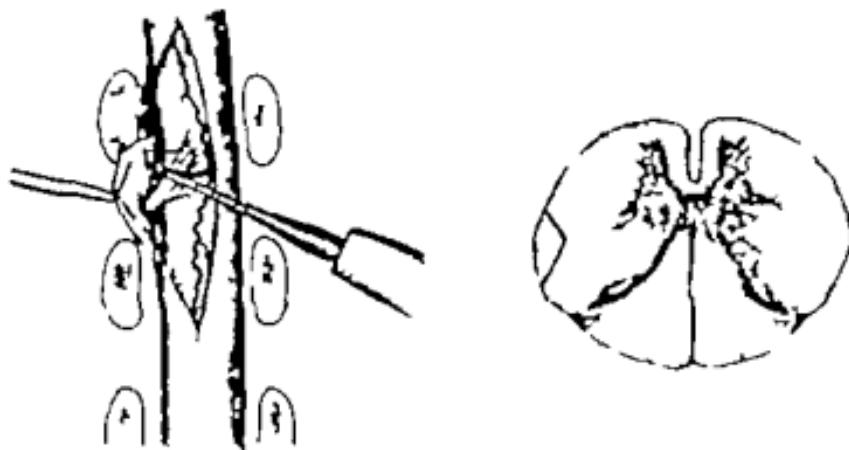


Fig. 738.—Incision of the left anterolateral tract at the third cervical segment. The cord has been lifted and rotated, the exit of the left anterior root being indicated. The part of the cord that was incised is shown in the accompanying illustration.

of the cord in the situation of the anterolateral tract. The maximum depth of this incision was 3 mm. and its length on the surface of the cord was about 5 mm. Slight oozing followed the incision of the cord. The manipulation of the cord and the incision through the left anterolateral tract were absolutely free from pain although, as has been said, no local anesthesia was applied. The dura was left open for decompressive purposes and the wound closed in the usual fashion.

Strangely enough the relief of pain in the right arm was not evident the first four or five days after operation, but

Microscopic examination showed adenocarcinoma identical in appearance with the slides of the original breast tumor.

**Postoperative Course.**—There was absolutely no relief from the pain in the right arm which was the patient's chief complaint before operation. This persisted day after day requiring frequent administration of morphin. About four weeks after operation it was clear that something further would be necessary to relieve the patient, the presumption being that the pain persisted because of the invasion of the cord by the remnants of the tumor. The patient was gradually losing ground and became querulous, and it was almost impossible to make a satisfactory examination. There was, however, no evidence that the removal of the tumor had been followed by any change in the neurologic manifestations. I therefore decided that the only hope for prolonged relief of pain in the right arm would be a division of the left anterolateral tract above the site of the tumor that is, at the third cervical segment. The question arose, Could the anterolateral tracts be divided at this level without fatality? I believe it has been stated that these tracts could not be divided above the thoracic region, but the discussion, as I remember it, did not convince me.

**Operation Four Weeks After the Primary One—Division of the Anterolateral Tract.**—Local anesthesia, 1 per cent novocain to skin and muscular planes, but none to dura or spinal cord.

The line of cleavage of the former operation was not discovered until the seventh cervical spine was removed. The wound was then laid open bluntly. The silk sutures of the dura were visible as such the dural incision being firmly healed. They were removed and the dura laid open higher than in the previous operation. The under surface of the dura was apparently adherent to the bed of the tumor on the right side but this was not definitely determined because the separation on the right side was not carried out. The cord above the level at which the tumor had been situated was freely exposed, particularly on the left side. It appeared perfectly normal. The posterior left fourth cervical root was gently elevated to expose

## ENDOTHELIOMA OF CONUS AND CAUDA EQUINA. DIFFICULTIES IN DIAGNOSIS. LAMINECTOMY AND REMOVAL OF TUMOR. RAPID IMPROVEMENT WITH RETURN OF REFLEXES

In this patient, Mrs. F. fifty-eight years old, the first symptom beginning three and a half years before admission to the hospital, was burning pain about the left hip. This remained the sole manifestation for two years, when it began to abate. Pain in both feet gradually extending up to the knees then began, and this became steadily worse and more constant. Weakness of the lower limbs appeared soon after and has been more slowly progressive than the pain. The patient has been bedridden for a year more from pain than disability. For several months there has been vesical and rectal urgency and incontinence on a number of occasions. Glycosuria has been noted and the case was apparently treated as one of diabetic neuritis.

During three weeks' observation in the neurologic service of Dr. B. Sachs the patient suffered almost constant pain in the lower limbs unless relieved was given by morphin. Incontinence of urine and feces occurred occasionally. There was marked loss in power in the legs more pronounced on the left side, together with some spasticity. Bilateral complete drop-foot. The knee-jerks were absent, the Achilles reflexes present, but reduced. A tendency to ankle-clonus, more marked on the left side was noted. There was a bilateral Babinski phenomenon. The only discoverable disturbance in sensation was an ill defined area of very slight reduction in pain and tactile sense over the buttocks. Two disturbing factors in the diagnosis came up. One was a greatly enlarged uterus and the question was if we were dealing with a spinal metastasis from a uterine growth. The other was the x-ray examination. This showed a marked spondylosis of the lower dorsal and lumbar vertebrae.

thereafter it was complete and the patient never complained of any other sensation than a rushing of blood in the right hand.

Incontinence of urine was present for a number of days after operation, and about the same time there were some twitchings in the legs. These manifestations, however cleared up completely before the patient left the hospital. Upon neurologic examination about one week after operation the loss of temperature and pain on the right side below the level of the third cervical segment did not appear to be complete. Indeed, subsequently islands of retained sensation of temperature and pain were to be found particularly over the right half of the chest.

The final examination before leaving the hospital showed that this loss was practically complete, and examination subsequently at another institution presented the same evidence of complete or almost complete division of the anterolateral tract. The patient still remains free from pain one year after operation.

arachnoid attached to the conus and a little dissection anterior to it, the lower rounded pole of a tumor was seen extending just below the end of the conus. The problem of attempt at removal now came up. Additional dissection showed that a number of root's of the left half of the cauda equina and some

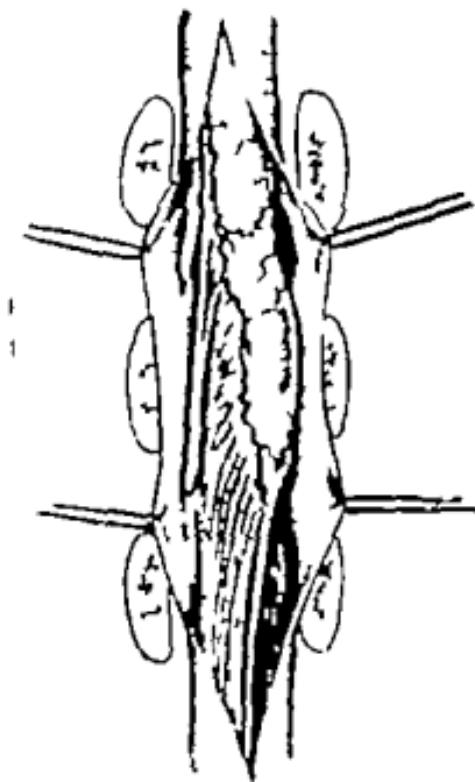


Fig. 739.—Posterior bowing and rotation of conus and cauda equina seen when the dura was opened. The tumor became visible only after these structures were displaced.

from the right side were intimately attached to the capsule of the tumor but that the ventral surface of the conus was not adherent. It was manifestly out of the question to sacrifice the attached roots unless grave additional loss of function of sphincters and the lower limbs was to be inflicted. Further

with well-developed osteophytes, and the dural sac might as a result be sufficiently compressed to lead to the neurologic manifestations I have noted. I shall take occasion in another case to indicate the misleading interpretation that can be made of the x-ray examination in spinal cord tumor suspects, but cannot refrain from emphasizing this point here. The x-ray examination is of great value in determining the presence or absence of a neoplasm of the vertebral column. It is of no value in demonstrating the presence or absence of a spinal cord tumor except in those rare instances of calcification in the tumor. The fact that the x-ray plates show the results of arthritis of the vertebral column, even when localized over the area in which a tumor is suspected to exist, as in this case, should in no way quiet a previous suspicion that a spinal cord tumor may be present.

I shall not enter into the interesting details of the question of localization of the tumor suspected to have been present in this case. They illustrate anew that the stereotyped pictures of affections of the lumbosacral cord, the conus, and the cauda equina, often contrasted in table form in text books on the subject, can be greatly altered by the tumor. There was sufficient evidence to justify a provisional diagnosis of a tumor in the region of the junction of cord and cauda equina and, therefore, to justify operation.

**Operation, with Comments.**—The spines and laminae of the eleventh and twelfth dorsal and first lumbar vertebrae were removed to expose the termination of the cord and the beginning of the cauda equina. Upon opening the dura between traction sutures there was an escape of normal quantities of cerebrospinal fluid. After the excess fluid was mopped up the conus and beginning of cauda equina were found adequately exposed and were inspected. A tumor was not seen. The conus and upper cauda were found pushed back and rotated to the right, so that the left lateral surface of the conus and the left half of the cauda were chiefly visible in the field. The first impression was, therefore, of a tumor of the body of the twelfth dorsal vertebra as the cause of the dislocation of the cord structures. However by gentle traction on the pla-

time to look out for these patients. I cannot recall a single instance of bed-sore among all the spinal cord injuries we cared for at United States Mobile Hospital No. 2.

The day after operation all the reflexes present previous to operation were obtained. I make a point of retention of reflexes as significant of minimal cord trauma in another case and shall not stress it here. The root pains disappeared promptly. The right knee-jerk appeared for the first time five days after operation, the left knee-jerk returning several months later. Beginning recovery from drop-foot was noted nine days after operation, and thereafter the improvement in power in the lower extremities was rapid. Complete continence of the vesical and rectal sphincters existed two weeks after operation.

Improvement continued after the patient left the hospital. It is now one year since operation. There is occasional pain in the left thigh, some vesical frequency during the day and a little weakness in the left leg as compared with the right. Other wise the patient is well as yet. Power in both limbs is excellent, although the right leg exceeds the left. All reflexes are present, the Babinski phenomenon not obtained. There are no discoverable sensory disturbances.

Isolation of the neoplasm away from the cord structures was decided upon. The tumor was then found to be a hemispheric one about 2.5 cm. in each diameter occupying the entire space in front of the cord structures and broadly attached to the inner surface of the dura anteriorly. Accordingly I decided to attempt to shell it out here, although I could not be certain that the tumor did not arise from the bone. By an incision of what was found to be an outer capsule and patient dissection in this plane of cleavage the tumor was lifted out and was free to the line of attachment of capsule to roots of the cauda equina. Here the capsule was detached by sharp dissection, leaving a thin layer attached to the roots of the cauda equina, and the tumor was free. After its removal the field was inspected. Apparently complete removal of the neoplasm had been accomplished with the possible exception of the narrow strip of capsule left attached to the roots of the cauda. There was no bleeding within the dural sac and the wound was closed in layers in the usual manner. A voluminous dressing incorporating layers of gutta-percha was applied in order to protect the incision from urine and feces. As I have stated, the tumor was spherical, about an inch in each diameter of grayish color and of rather firm consistency. Microscopic examination. Endothelioma.

The patient was placed on a water-bed, her skin kept dry and clean, and her position changed from time to time to avoid the appearance of pressure lesions. I believe the significance of so-called bed-sores that appear in cases of spinal cord tumor or injury is clear. I cannot subscribe to the view that they are "trophic lesions referable to the cord injury" certainly not in the great majority of instances. Conceding a greater tendency to their development in spinal cord affections, I believe their appearance can be directly ascribed to poor nursing care and conversely their non appearance to good nursing. A tribute should be paid to the nurses who served in the front area during the World War as regards the care they gave to the unfortunate sufferers from spinal cord wounds. Despite the fact that their hours were fully occupied they managed to take sufficient

## GIANT ENDOTHELIOMA OF MEDULLA. SUBOCCIPITAL CRANIOTOMY AND REMOVAL OF ARCHES OF ATLAS AND AXIS UNDER LOCAL ANESTHESIA

THE symptoms in this patient (Mrs. S. thirty-eight years old) began during a pregnancy eighteen months ago. Severe and persistent occipital pain was the first manifestation, to be followed by weakness of the right arm and, later of the right leg. Despite the progressive course of these symptoms parturition was normal. One year ago weakness of the left arm was first noticed to be followed shortly by weakness of the left leg. Finally all four extremities became considerably wasted and almost completely paralyzed. Difficulty in urination and constipation began about four months ago, have been progressive, but incontinence has not developed. Shortly before entering this hospital the patient was under observation for a month at another institution, where a diagnosis was made of glioma involving bulb and cord. Difficulty in breathing first appeared during that period.

Outstanding features of the physical examination were Marked atrophies and paresis of all four extremities, more profound on the right side, with superficial reflexes absent and deep reflexes greatly reduced. All sensations diminished or lost over the entire body except the face and anterior half of the scalp. Limited motions of the head. Wasting of some of the musculature of the neck. Lateral nystagmus. Paralysis and fibrillary twitchings of right half of tongue. Respiration purely diaphragmatic, with absolute immobility of thorax, labored and rather hurried.

During the period of nine days observation before operation occipital pain became more severe and at times agonizing. The patient complained of a sensation of heavy weights pressing on her body but the most alarming symptom was the rapidly increasing difficulty in breathing.



improvement by operation could not be anticipated in this direction. The chief indication for operation and indeed, an urgent operation lay in the impending respiratory failure from medullary compression. The plan, therefore, was to expose the region of the medulla widely in the hope of encountering a tumor that could be lifted away from it and thus relieve compression—direct decompression. In order to do so safely it would be necessary to remove the lower part of the occipital bone including the posterior half of the foramen magnum and the arches of atlas and axis, and to incise the dura over the cerebellar lobes before opening it over the medulla. General anesthesia was, of course, contraindicated by the respiratory condition, and I believed that relatively little local anesthesia would be necessary in view of absent or diminished sensation in the proposed operative field. This proved to be the case.

**Operation.**—With the patient in the prone position and shoulders up to the end of the table her head was supported in the lap of an assistant. I find this more satisfactory than the use of a metal head-rest in laminectomy in the cervical region or in suboccipital craniotomy. After infiltration with 1 per cent. novocain in the skin and  $\frac{1}{2}$  per cent. solution in the depths a cross-bow incision was made as for a suboccipital craniotomy the vertical half being extended downward somewhat further than in the Cushing incision. The musculature having been divided transversely close to the occipital bone and separated in the median line down to the third cervical spine, the periosteum was stripped away. Trehpine openings were then made in the occipital bone on each side of the median line the openings joined up and the lower part of the occipital bone removed with rongeurs. This part of the operation, practically the same as a suboccipital craniotomy is often trying because of profuse bleeding and I had occasion in this case as I have had in other suboccipital craniotomies to note the relatively insignificant bleeding that goes with the use of local anesthesia for the operation. To obtain the widest latitude for medullary decompression the posterior three-fourths of the rim of the foramen magnum were removed. The marginal

**Diagnosis.**—A detailed discussion of the neurologic manifestations would be out of place. I may say however that the march of events was classic for a spinal cord tumor in the cervical region—invovement of arm and leg on one side then the arm and leg on the other and the later development of bladder and rectal disturbances. There would have been little difficulty in diagnosing a tumor lower down in the cervical cord and the patient would undoubtedly have been operated upon at a much earlier period under those circumstances. Tumors involving the medulla are so unusual, however that a hesitancy in making such a diagnosis is not surprising and commoner bulbar lesions are considered. But in this case the root pains over the occiput, loss of sensation over almost the entire body and the evidences of medullary involvement, in addition to the quadriplegia, clearly indicated a tumor pressing on the medulla from the right side.

One finding in the physical examination I have not mentioned was a rounded prominence in the region of the body of the second or third cervical vertebra as felt through the pharynx. This in conjunction with the x-ray examination, showing an increased density and tendency to coalescence of the bodies of the upper three cervical vertebrae, led to a consideration of such conditions as osteoma or a high cervical Pott's disease in the diagnosis. These were ruled out because of insufficient evidence. I wish to say that in my experience the result of x-ray examination of the spine in cases of suspected spinal cord tumors may be misleading. Roentgenologic examination is, of course, of prime importance in the diagnosis of tumors involving the spinal column, and is essential in the effort to exclude these lesions if a spinal cord tumor is suspected. But when the x-ray picture shows lesions such as arthritis of one or more articulations, exostoses, etc. it is unwise to leap to the conclusion that these lesions are the cause of the spinal cord condition. I have met instances in which such false interpretation has led to unfortunate delay in operation.

**Indication for and Plan of Operation.**—The quadriplegia and muscular wasting in this patient were so marked and marked

bellar lobes, separating them for a distance of 2 to 3 cm. On first impression it appeared a simple matter to lift this tumor out of its bed and thus relieve pressure on the medulla. Blunt dissection with fine elevators was begun away from the medulla and upper cord. The tumor was readily separated from the right lateral surface of the medulla deeper down, however it was firmly held in place. I then found that the presenting growth was only one part of the tumor the remaining and greater portion extending around the anterior surface of the medulla and upward under the cerebellar lobes. To dislodge this major part of the growth would inevitably have meant additional trauma to the medulla already greatly compromised and I had to content myself with excision of the presenting portion that crowded the medulla to the left. After its removal the medulla and upper cord came well into view shifting gradually toward the median position. It was astonishing to think that life had been compatible with the degree of compression of the medulla that was now noted—it was seen to have been greatly distorted and compressed to less than one-half the normal diameter. Bleeding from the bare cut surface of the tumor was controlled by pressure. A radium needle was hooked into the growth to be withdrawn by the attached thread later. The dural incision was left wide open, musculature, aponeurosis, and skin were closed in layers.

**Postoperative Course**—There was no evidence of post operative shock, the pulse returning to its previous rate and quality shortly after operation and the respirations remaining unchanged. About thirty-six hours after operation, when the patient's condition appeared satisfactory respirations ceased without the slightest warning and could not be brought back. The pulse stopped about ten minutes later.

At the postmortem examination the remaining portion of the tumor was found attached to and apparently arose from the inner surface of the dura anterior to the medulla, and could be lifted out by drawing the medulla to one side and elevating the cerebellar lobes. It measured 3 x 4 x 5 cm. Pathologic examination Endothelioma.

sinus was then tied off on both sides and the arches of atlas and axis were widely excised with rongeurs.

The dura over cerebellar lobes and medulla was tense, slightly pulsating. It was divided transversely across the median line the straight suture caught between fine clamps and tied off. There was an escape of considerable cerebrospinal

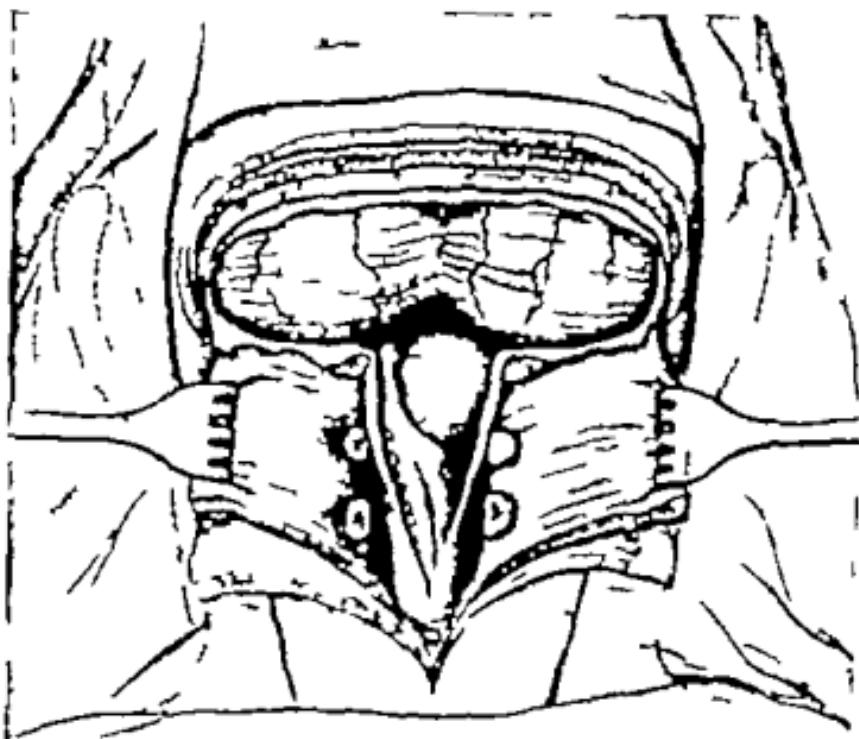


Fig. 740.—Appearance upon incision of dura over cerebellum, medulla, and upper cervical cord. The dislocation and compression of the medulla by the tumor are well shown.

fluid under high pressure. The patient's condition remained unchanged. The dural incision was now extended downward vertically over the medulla and upper cervical cord. A firm, rounded, reddish-gray tumor came into view once occupying almost the entire spinal canal. Only a thin strip of medulla and upper cord could be seen crowded far over to the left. The upper pole of the tumor lay beneath and between the cere-

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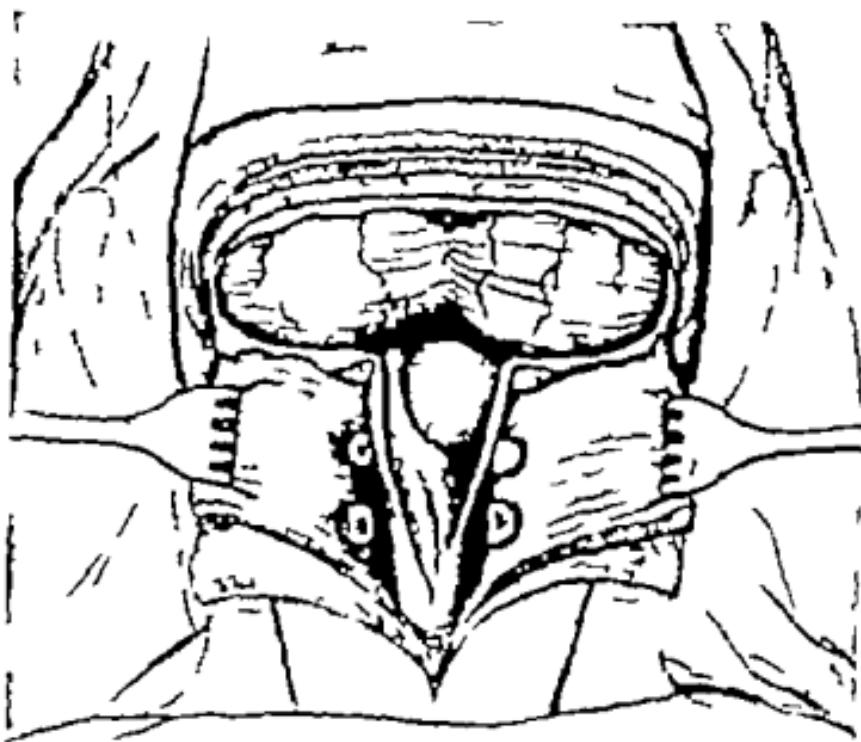


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## LARGE CERVICAL CORD TUMOR WITH SLIGHT SENSORY MANIFESTATIONS. LAMINECTOMY AND RADICAL EXCISION OF TUMOR. "CURE" NOT COMPLETE TWO YEARS AFTER OPERATION

Mr. B. forty-seven years old when admitted to the hospital. Eight months before he began to have stinging pains in the third, fourth, and fifth fingers of the left hand, followed by wasting of the musculature of the hand forearm and shoulder girdle. Two months later the left leg began to be weak and stiff so that there was difficulty in walking. Slight stiffness in the right arm and some stiffness of the right leg developed shortly before admission to the hospital. Difficulty in urination became manifest in that period.

The patient was in the hospital for three months before operation, during which time there was little if any evidence that the manifestations of the disease were progressive. Pain in the fingers, complained of at the outset, had largely subsided. He was up and about, without increasing difficulty in locomotion. These facts are all the more remarkable in the light of the lesion found at operation.

**Examination.**—The right pupil was slightly larger than the left. Nystagmoid movements in extreme positions of the eyeballs. Considerable wasting and reduction in muscular power of the left arm to a much lesser degree of the right. Spasticity and weakness of both lower extremities, with increased reflexes, ankle and patellar clonus all more marked on the left side. On the other hand, sensory disturbances were insignificant. Tactile sensation was intact. There was diminished sensation to pain over the ulnar side of the left hand, and to a lesser degree over the left side of the trunk and the left lower extremity. The same could be said of temperature sense, but these findings were by no means definite. A sensory level was at no time clearly established at any one of the many examinations.



ation of its relations to the cord has every chance of inflicting additional and, perhaps, irreparable damage to the cord. Indeed, the era for specialization in spinal cord surgery shall have passed I believe as soon as there is general recognition of the fact that the spinal cord registers, and perhaps permanently any undue or rough handling. An appreciation of this fact combined with a good working knowledge of neurology should make it possible for any surgeon to perform these operations properly. Adequate exposure is a prime requisite. In this case the spine and arch of the fourth cervical vertebra were removed and the dura opened that much more without finding the limit of the lesion. Accordingly the spinous process and laminae of the third cervical were removed and the dural incision further enlarged. The cord was then seen for the first time lying beneath and to the right of the tumor. It was now clear that we were dealing with an extramedullary tumor and it was safe to attempt to dislodge under inspection, its upper pole. The tumor was grasped and gently drawn upon away from the cord. The upper pole immediately slipped out from under the arch of the axis and the tumor was found to be free from the cord. The lower pole was then withdrawn from its pocket just below the lower limit of the dural incision—the level of the first dorsal spine. The tumor was now free except for its broad pedicle and, presenting a benign, cystic appearance, the temptation was strong to strip it out subcapsularly. Local recurrence after spinal cord removal is not uncommon and is apparently directly referable to the subcapsular removal of these growths. Unfortunately such a procedure seems imperative at the present time in those cases in which the capsule is intimately attached to the spinal cord. In this case a little dissection showed that a part of the pedicle was vascular arising from a convoluted mass of spinal veins lying on the posterior surface of the cord the remainder of its attachments being two posterior roots entering the capsule of the tumor. The roots were first sacrificed and then the vascular pedicle was tied off with fine silk close to the convoluted mass of vessels I have mentioned. After removal of the tumor oozing from the tor

made by the neurologists of the staff did there appear to be a zone of hyperalgesia referable to the first dorsal segment.

The diagnosis thus rested between a multiple or ankylosis lateral sclerosis, on the one hand and an intramedullary spinal cord tumor on the other. Operative intervention was only considered because the latter could not be excluded, and had to be regarded purely in the light of an exploration. With a patient not suffering from the evidences of an advanced spinal cord lesion I regard an exploratory laminectomy as safe as an exploratory laparotomy in a parallel intra-abdominal condition. Exploratory laminectomy can be abused exactly as exploratory laparotomy can be and has been abused. But until finer diagnostic methods can be evolved, the best outlook for improvement in the results of spinal cord surgery rests upon our readiness to advise and accept exploratory laminectomy in early and doubtful cases. The next case I present shows of what little avail it is to remove a spinal cord tumor when cord involvement is advanced and the patient exhausted and debilitated by his disease. In this patient with far less advanced cord compression some sequelae of cord involvement are left after two years, as we shall see.

Operation, with Comments.—The pupillary differences indicating a lesion low down in the cervical cord a low cervical laminectomy was decided upon. The patient was placed in the prone position, shoulders at the edge of the table his head flexed and so supported in the anesthetist's lap. A typical laminectomy incision was made with the removal of the spines and laminae of the fifth, sixth and seventh cervical vertebrae. The dura was found tense and immobile. Upon opening it between traction sutures there was a gush of cerebrospinal fluid, and tumor surface or spinal cord containing a tumor at once presented in the dural gap. The spinal cord could not be identified as such and posterior roots were not seen. Even though it was impossible at this stage to determine if the condition was a remediable one I considered it essential to have a full view if possible of the whole lesion. The point is, that attempts to dislodge a spinal cord tumor without clear knowledge

many cases, and to find that these come to pass. But I doubt if a perfect result can be looked for when any degree of cord compression has existed for some months or longer.

As in other cases so here after the rapid strides in the first month to six weeks, the subsequent improvement has been much more slow. I shall not detail the stages, but briefly indicate the present condition of the patient. He is free from pain. Very slight traces of atrophies are to be seen, but the left hand grip is considerably weaker than the right. The gait is slightly spastic due to the increased tone in the left lower extremity in which increased reflexes, ankle and patellar clonus are yet present. He is able to do light work, but cannot return to the laborious occupation he had before the disease began.

tuous network of veins was persistent and was not controlled by tampon. Accordingly a bit of muscle from the margin of the incision was held in place over the oozing area by the gloved finger—the so-called postage-stamp graft—and this promptly checked the bleeding. The cord was inspected before closure of the wound. It has been pushed forward and to the right by the tumor was flattened, and presented a long, rather deep depression on the left side where the tumor had rested. The dura was sutured with fine silk and the remainder of the wound closed in layers by catgut in the usual manner. A posterior molded plaster-of Paris splint for the support of the head and neck was applied.

The grayish white tumor of fleshy consistency was about 9 cm. long, 2 to 2.5 cm. in the other diameters. A number of small cysts were found scattered through the neoplasm.

*Microscopic Examination*—Endothelioma with cystic and hemorrhagic degeneration.

The postoperative convalescence was uneventful. Reflexes in the lower extremities were found unchanged in the immediate postoperative course and catheterization was not required. The reason I indicate this is to emphasize again a point I have made before. It has been said that the knee and ankle-jerks disappear after spinal operations, to appear in twenty-four hours or later and these changes have been held to be due to the laminectomy and simple incision of the dura. I have been unable to verify this, and the patient I present is one of a number of examples I believe that the postoperative disappearance of reflexes present before operation must be attributed to trauma inflicted on the cord, unavoidable no doubt in some of the more difficult cases, but trauma just the same. Similar interpretation must be made I think, of catheterization required after operation when it was not necessary before.

Rapid improvement took place in the first weeks after operation, so that one might have been led to anticipate perfect result. My experience with follow up has shown me how illusory such expectation may be. It is possible to predict improvement, even great improvement, relief of pain, and so on. In

many cases, and to find that these come to pass. But I doubt if a perfect result can be looked for when any degree of cord compression has existed for some months or longer.

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SMALL EXTRAMEDULLARY TUMOR AT FIRST DORSAL  
SEGMENT VAGUE LOCALIZING SIGNS. ADVANCED  
PARAPLEGIA. PREVIOUS OPERATION AT ANOTHER  
LEVEL. LAMINECTOMY AND REMOVAL OF TUMOR.  
COURSE UNINFLUENCED BY OPERATION

In this case a man sixty two years old, the illness had begun five years before. Weakness and stiffness of the right leg were first noticed, followed by similar involvement of the left lower extremity. Marked spasticity gradually developed, extending upward from the legs to involve the entire torso. The patient has been helpless for about two years, and has suffered increasingly severe contractions of the trunk and lower extremities. Difficulty in urination appeared as a late manifestation and total incontinence has been infrequent. Bowels became obstinately constipated, with occasional tendency to incontinence. About two years before admission to the hospital a laminectomy was performed in the midthoracic region at another institution. A flattened cord was found and the condition interpreted as lateral sclerosis.

Physical Examination.—At frequent intervals the patient suffered from agonizing contractions of the musculature of the back and chest on some occasions, the lower extremities on others. He was rendered completely helpless by the extreme spasticity of the legs, held in extension and immovable. All the neurologic evidences of advanced pyramidal tract involvement were present. I shall not detail all the areas of diminished and lost sensation over the lower trunk and extremities, and merely say that they were not precise enough to indicate a tumor level.

The patient was under the care and observation of Dr Abrahamson for three months before there was any evidence of disturbed sensation of localizing value. It was his opinion

that the condition was one of spinal cord tumor largely occupying the ventral surface of the cord but with the vague sensory changes the level for a possible operative intervention could not be determined. Finally toward the end of the three-month period a narrow ill-defined belt of hyperalgesia could be outlined referable to the third or fourth dorsal segments. In addition, I found a strip of slightly diminished sensation along the medial aspect of the right forearm and hand (first dorsal segment). The difficulty in localizing some case of spinal cord tumor can be appreciated by the brief recital I have given of the problem encountered in this patient.

As soon as the sensory changes I have mentioned were found, operation was promptly decided upon as the one hope of offering some relief from dreadful suffering, but with no expectation of 'cure.' Dr Abrahamson and I agreed that a tumor should be sought in the region of the second to fourth dorsal segments, and, if not found here to be searched for at the first dorsal segment (in view of the sensory disturbances in the right hand).

**Operation, with Comments.**—Typical laminectomy with the removal of spinous processes and laminae of the second and third dorsal vertebrae. The dura was incised between traction sutures with the escape of small quantities of cerebrospinal fluid. The cord presented a flattened atrophic appearance and courting along its posterior surface was a mass of convoluted distended veins. The picture was similar to what has been termed "varicose veins of the cord," and has been held accountable for symptoms simulating spinal cord tumor. I have never felt satisfied, however, that tumor symptoms could be induced by other lesions found at operation unless the cord is actually compressed or invaded by such lesions for after the first stage of root irritation tumor symptoms are characterized by the evidences of cord compression. I do not, of course refer to such gross lesions as hemangioma or aneurysm of the spinal vessels, in which cord compression may be as great or greater than in many cases of tumor. If the suspicion of a spinal cord tumor has led to a laminectomy I believe the most painstaking search consonant with the patient's condition should be made for it.

and one should not be content with finding abnormalities that may be secondary to tumor or in any event, relatively trivial. I think it should be frankly stated that spinal cord tumors are not infrequently found in regions distant from those in which they have been suspected to exist even with the most careful methods of present-day examination. And so in this case the tumor was further sought by removal of the spine and laminae of the first dorsal vertebra. No additional lesion being visible, the spine and laminae of the seventh cervical were removed. An insignificant part of the tumor was now brought into view. For its adequate exposure a portion of the posterior arch of the sixth cervical vertebra was cut away. The tumor was almost completely hidden from view by an overlying cap of pia-arachnoid. After the latter was detached the exceedingly dense small gray tumor  $1\frac{1}{2} \times 1 \times 1$  cm. was partly exposed. It was deeply embedded in the right lateral and anterior surfaces of the cord. The purpose of the operation being relief of pressure on the cord and not cure, no effort was made to remove the tumor with capsule but rather to shell it out intracapsularly. This was done by blunt dissection away from the cord, but could only be accomplished after considerable dissection owing to its deep and fixed situation. Active bleeding from veins in the tumor capsule was controlled after detachment of the neoplasm. The deep indentation in the cord showed little tendency to fill in after the tumor had been removed. Layer closure of the wound.

#### Microscopic examination of the tumor. Psammoma.

Subsequent Course.—No improvement could be noted as a result of the removal of the tumor. After a week or two in which there may have been some reduction in the frequency and severity of the contractions, they existed as before. Spasticity remained unchanged. About six weeks after operation the patient's general condition began to deteriorate apparently as the result of a pyelonephritis, and he died three weeks later.



## CLINIC OF DR. ABRAHAM O. WILENSKY

MEIR SIMAI HOSPITAL

### THE NEUROLOGIC MANIFESTATIONS OF FRACTURE OF THE SKULL (CRANIOCEREBRAL INJURIES)

PRACTICALLY alone among all the varieties of injuries to which the human skeleton is subject, fracture of the skull is distinguished by the relative unimportance of the bony lesion itself and by the preponderating gravity of the associated and complicating lesions in its contiguous interior structures, especially those in the brain. Taken by itself a fracture of the skull is a relatively benign lesion, but in conjunction with any trauma to the underlying brain the innocuousness of the total injury disappears as lesions of the utmost gravity result, even to those productive of an immediate fatality. So that, while it is of great importance to possess a complete understanding of the bony lesions as these occur it behooves us at the same time to endow ourselves with complete comprehensions of those associated lesions in the brain and cranial nerves, in the cerebral arteries and venous sinuses, and in the meninges which can possibly occur with knowledge of their pathology and of their clinical indications and symptoms by virtue of which these can be recognised. Then these can be immediately corrected when and where possible in the hope that the neurologic lesion can be caused to disappear entirely or at least, compensated, so that the ultimate damage may be minimised as completely as lies within human power.

The scope of any head injury is very large—from the most insignificant to the most extensive. There are cases in which the cranial injury is of comparatively small size and there are others in which the entire skull is cracked like an egg-shell.

With bony injuries of such varied nature and extent the associated intracranial injury may show a similar diversification. The injury may be limited to a single cranial nerve, to a venous sinus, to a localized and comparatively small area of contained brain tissue, or the entire brain may be disorganized more or less completely. The latter are immediately fatal injuries. There is no rule about the relative proportions of the resulting lesions in the cranium or in its contained structures, and minimal lesions in any one may be associated with maximal lesions in the other. Between these two extremes the number of possible combinations number infinity.

The lesions in the brain may consist of numerous small contusions localized in a single area or wide-spread throughout the major portion of the brain. Pathologically these consist of small capillary ruptures with surrounding minimal and sub-minimal hemorrhages. They may not be visible to the naked eye and only demonstrable under the microscope. In more extensive lesions there are one or more lacerations in the brain tissue in addition. The amount of hemorrhage is considerable though not always sufficient to produce perceptible or recognizable symptoms. In others the surface of the brain cortex loses its normal morphology and is replaced by a mass of grumous, blood-stained, semisolid material resulting from a complete disorganization of the normal structure under ordinary conditions. This does not extend very deeply but after extraordinary exhibitions of violence the disorganization extends both deeply and over a wide area of brain substance. In extreme cases the entire brain is involved. These are immediately fatal cases.

Perceptible lesions in the brain are not limited to these actual destructions of brain tissue or to the severance of established functioning nerve tracts, but may result from extraneous causes. The most common of these is produced by pressure from without either by a depressed fragment of bone or by the pressure of a large blood-clot. The latter must necessarily result from extensive hemorrhage either from a large vessel or from the parenchyma of the brain. The accumulated blood-clot gathers most commonly over the surface of the brain either between

the dura (subdural) and the bone or directly over the cortex (subarachnoid). In other cases the clot is situated in the midst of the brain tissue either at the bottom of a deep laceration or independent of the latter. In these last cases the mechanism resembles somewhat that of an ordinary apoplexy and because of this, quite frequently there is difficulty in making the differential diagnosis between fracture and apoplexy especially when no history of any kind is available as in the circumstance of an unconscious patient picked up on the street. Bleeding can take place into one of the ventricles, and the latter may become acutely distended with fluid and clotted blood and produce most serious symptoms and effects.

Pressure of this kind causes an anemia of the underlying brain, which can go on to necrotic changes unless the pressure is relieved in time. A less common cause of neurologic disturbance is caused by an interference with the blood-supply of some portion of the brain either by pressure upon or by thrombosis, or by both of some important blood channel, especially the longitudinal sinus. These, too when relieved in time either spontaneously or through operative interference may be followed by a complete disappearance of any perceptible symptoms.

As a general rule it ought to be expected that the underlying brain injury will lie in anatomic relationship with the fractured area. This is, however not absolutely true. Increasing experience in the autopsy room has demonstrated abundantly that brain injuries may exist in different areas independently of the situation of the skull fracture. Indeed brain injuries have been found independently of any fracture at all. A frequently found finding—just to indicate a single one—is a fracture in the general region of one parietotemporal region and a contusion or laceration of the brain in the general region of the tip of the opposite temporo-sphenoidal lobe. In these cases a contrecoup mechanism is assumed.

In about 40 per cent. of the patients with head injuries sustained in civil life no abnormal neurologic findings are present. This does not indicate that no brain injury coexists but rather that many times the injury is either not extensive enough or is

of such a nature as to produce no perceptible subjective or objective symptoms. Cases with no neurologic symptoms at the time of examination can be divided into two groups (1) The very mild cases the cases with scalp contusions and lacerations in whom fracture of the skull is not suspected but subsequently demonstrated by x-ray examination. These make up the largest number (2) Cases with such quickly disappearing symptoms that by the time the patients reach the hospital (usually within an hour) evidence of any neurologic disturbance is not elicitable.

The symptoms which brain injuries associated with skull fracture do produce are one of two kinds. One group of these is composed of general symptoms, related to the brain as a whole and not referable to any one differentiable area. This group, in its turn, is divisible into two important subgroups in one of the latter the signs have precise similarities to those general abdominal symptoms which usher in the manifestations of any intraperitoneal lesion, such as the initial abdominal spasm and generalized cramp-like pain. These general symptoms reflect a general or diffuse interruption of brain function, are associated with the primary general contusion and initial hyperstimulation of brain substance and have most to do with the primary unspecialized functions of the brain. Ordinarily one speaks of this phenomenon as "concussion." Concussion is a temporary phenomenon and its principal immediate symptom is loss of consciousness associated and secondary symptoms are headache, nausea, vomiting and various degrees of shock. Any head injury may exhibit this phenomenon in a very mild in a very extreme degree. In the former the symptoms disappear quickly and the patient is none the worse for them in the latter the period of unconsciousness becomes protracted to a considerable interval and may be followed by annoying sequelae notably by headache continuing for number of weeks or months. In some cases the concussion is of such an extreme degree as to result almost immediately in death the sudden interruption of the vital functions is of such a profound nature as to make impossible their restoration.

The second of these subgroups is of more vital importance because of the potential danger of its essential features and because of the therapeutic possibilities. I speak of the cases of head injury in which a general and progressively increasing general intracranial compression occurs. The symptoms are general in that the entire brain is concerned but a certain amount of differentiation occurs and is distinguishable in the clinical picture because the brain is involved in its major differentiated functions in an order the reverse of their development—that is, from the highest, localized in the cerebral cortex, to the lowest, localized in the medulla. Compression appears very quickly in most of the cases. An initial stage of concussion is not always distinguishable in the clinical picture. The cause of such compression is almost always hemorrhage and the commonest source of the bleeding is the middle meningeal vessels. Compression can also occur from edema. The typical signs of a progressive intracranial compression following an injury include (1) progressively increasing stupor (2) progressive slowing of the pulse and respiration (3) a rise of the blood-pressure followed by a fall in the later stages (4) swelling of the optic nerve heads (5) contracted pupils which dilate in the later stages (6) Cheyne-Stokes breathing other neurologic symptoms and signs may coexist. The compression that needs attention and requires early treatment is a progressive phenomenon it includes a progressive compromisation of all the centers proceeding from those high in the cortex to those low in the medulla. It is most important to recognise the condition before the medullary centers are involved before that a prompt relief is possible later any relief is questionable and fatalities usually occur. The danger signs include (1) very slow pulse and respiration (2) low blood-pressure and (3) dilated pupils these are the signs which indicate medullary involvement.

Cases of compression are frequently complicated by well marked signs of focal lesions and in any given case it is important to be able to make proper judgment as to the relative importance of each component in the clinical picture. This is not always possible. It is important to remember that under

all circumstances a progressively increasing intracranial compression demands immediate treatment symptoms of other neurologic disturbance may be studied and treatment can be postponed until a proper moment arrives.

It is very important to be able to recognize those of the cases of compression which are due to edema alone inasmuch as in these cases operation is not suitable or is of no avail and may possibly do harm. The notes of Case I illustrate

**Case I.**—A boy nine years old was run over on the street and was immediately thereafter brought to the hospital. On admission the boy was in stupor and was bleeding from the nose and mouth. The neurologic findings included (1) left facial weakness, twitchings of the upper limbs (2) convulsions beginning in the left arm and spreading to the left leg and to the opposite side of the body. Signs of intracranial compression intervened and grew more marked during the next twenty-four hours, when it was determined to go in and relieve the compression. The exploration through a bone-flap showed that (1) no hemorrhage was present, (2) great tension and edema of the brain (3) some bloody serum in the basilar portion of the skull. No improvement followed the intervention and death followed twenty-four hours later.

The clinical picture in this case was definitely one of a progressively increasing intracranial compression and the character of the associated neurologic findings are those that ordinarily indicate the probability of a rather large hemorrhage. Yet exploration revealed only a marked edema of the brain. The differential diagnosis of intracranial compression from hemorrhage and that from edema is extremely difficult and is rendered more so by one's efforts to be as conservative as one can with head injuries. When the intracranial compression is due to edema, spontaneous recovery is possible. Our second case illustrates this point very well.

**Case II.**—This four year-old boy was picked up unconscious on the street and brought to the hospital. No history of any kind is available but a laceration on the forehead indicates that a head injury of some kind has taken place. When first seen

the patient was in deep stupor with loud noisy stertorous breathing and, altogether looked very badly. The pupils were widely dilated, although they still reacted to light and in the fundi the disk margins were distinctly blurred, especially on the nasal sides. There were no neurologic phenomena except an active condition of the knee-jerks. The systolic blood-pressure was 95 mm. Hg and the diastolic was 65 mm. Hg. The pulse was beating 68 times to the minute. There was no doubt that some compression was present and the signs increased somewhat during the next few hours nevertheless a conservative policy was adopted because the increase in the signs was very little. During the remainder of the day distinct improvement was noted, and by the end of the third day the neurologic status was normal. No intervention of any kind proved necessary.

Compare this case with the previous one. In this last patient compression was present, but undoubtedly the largest part of it, if not its entirety was due to edema. As the edema subsided the normal functions gradually returned.

The second large group of cases in which neurologic disturbances are present are those in which the signs indicate that only a localized area of brain or nerve tissue is involved. The commonest evidence of such neurologic disturbance is found in the condition of the reflexes. These can exist either alone, as isolated phenomena, or as part of a clinical picture indicating the presence of an extensive lesion in which the condition of the reflexes are necessarily incidental. The various reflex responses which are obtained may be equal or unequal on both sides, may be weaker than normal on one or on both sides, or may be similarly exaggerated. In many of the cases the immediate interval after the trauma, owing to the excessive overstimulation produced by the violence, is marked by a complete inhibition of many or all of the reflexes such a complete inhibition is practically always a temporary phenomenon, and one can confidently expect that very quickly the reflexes will return either in whole or in such condition as is permitted by the nature of the true resultant injury. Abnormal reflexes, such as an ankle-clonus, a Babinski or Chaddock, etc., are also frequently present.

These, too, can exist either alone as isolated phenomena or as part of more complex clinical pictures. In the absence of any definite complex of physical signs indicating the involvement of some definite differentiable region of brain and nerve tissue the presence of changes in the normal reflexes or the presence of abnormal reflexes are apparently without any definite bearing. Let me illustrate this with Case III.

**Case III.**—About two weeks ago this boy of nine years was injured in an automobile accident, the injury is in the neighborhood of the right parietal region. There was immediate unconsciousness, but no vomiting or external bleeding. The elicitable points in the neurologic status included (1) eccentric pupils which dilated and contracted alternately (2) absent abdominal and normal cremasteric reflexes (3) absent knee and ankle-jerks (4) bilateral Babinski but no ankle-clonus (5) negative fundoscopic examinations. The x-ray showed a Y-shaped fracture in the right parietal region. Consciousness was rapidly regained. Examination several days later showed a normal neurologic status, and the boy is now ready to go home.

In this patient the presence of these disturbances in the reflexes have apparently no bearing. It is important to remember this especially from the therapeutic point of view. Symptoms of this kind do not call for any active intervention, and under conservative forms of treatment the patients all make good recoveries. This statement should not be interpreted to mean that these reflex disturbances are mere vagaries which do not reflect any definite pathologic lesion in the nervous system rather that when they do exist, lesions must be present which are, perhaps, trivial, and can be recovered from fully or which can be made good by compensatory functional efforts.

Symptoms indicative of injury of differentiable area of brain or nerve tissue—that is focal symptoms—may be referable to any part of the body they are present in from 20 to 25 per cent of the patients. In many the symptoms are apparent immediately; in others the development of the complex is gradual; in one of our cases the symptoms appeared fortnight after the reception of the injury.

Among the cranial nerves the facial and auditory nerves are the commonest seat of disturbance after craniocerebral injuries not always does complete recovery follow. In one of our cases total blindness followed, this was probably an optic nerve lesion.

Focal signs referable to the extremities are most common. These may be generally grouped as those in which paralysis occurs and as those in which there are signs of cortical irritation. It is important to remember that frequently the symptoms of this general latter nature which are present immediately after an injury are due to the stimulation of the initial violence and that these are only temporary phenomena. One should wait a sufficiently long time to make sure that these are established symptoms before they are accepted. Our next case illustrates this point very well.

**Case IV**—This young boy was admitted to the hospital a number of days ago in an unconscious state within a very few minutes after having received a head injury in an automobile accident. Almost immediately he began to have clonic convulsions in one upper extremity which rapidly spread to the lower extremity of the same side. These were repeated a number of times during the next fifteen minutes. Our house surgeon immediately notified me and I saw the patient within a half-hour—about one hour—after the injury. The convulsions were repeated once more as I was examining the child so I had orders given to prepare the operating room, being under the impression that some intervention would be necessary. Within the next fifteen minutes however the child seemed to begin to come out of its unconscious state somewhat and the convulsions ceased and did not reappear. Operation was therefore not done, and we were all much gratified to see the child come out of its stupor during the night and to observe that no further convulsive seizure took place. As you see, the boy is now perfectly well.

Focal symptoms of an irritative nature need not necessarily be limited to any one extremity. All of us are familiar with the well-known forms of Jacksonian epilepsy limited to a single group of muscles. Similar symptoms may occur immediately

after craniocerebral injury. Cases in which there are various degrees of spasticity in one or more extremities are also common. Case IV illustrates the type of case with convulsions. When these are not temporary phenomena, but are well established, they form imperative indications for operative interference. However as we get to these more and more severe cases, whether the signs are those of irritation or whether they be those of inhibition, the nature of the total injury is often such as to cause either an immediate or fairly immediate fatality or to make futile any operative interference. This statement applies with great force to all of the observations in this clinic. Let me illustrate with the notes of the following case.

**Case V**—This patient was a man of adult age who was admitted in a comatose condition with constant twitchings in the left upper and lower extremity. There were no external evidences of any kind pointing to the probable location of the site of injury. The left side was hypertonic and exhibited exaggerated reflexes; the right side was hypotonic with diminished reflexes; a bilateral Babinski could be demonstrated. The very serious nature of the injury was more than amply evidenced by these findings, by the general condition of the patient with the extreme condition of shock, and by the widely dilated pupils. A bilateral craniotomy was, nevertheless, done as a last resort and showed (1) fracture of the left vault (2) rupture of the middle meningeal artery (3) subdural and subarachnoid bleeding with much brain laceration and (4) bloody cerebrospinal fluid under great tension. The patient died, of course.

A fatality after an injury of this kind is to be expected; one cannot hope to do impossibilities.

Focal symptoms of a paralytic nature are classified as regards the number of extremities involved—monoplegia—when one extremity only is involved; diplegia—when two similar extremities are involved; hemiplegia—when one-half of the body is involved. Paralytic symptoms are in the largest number of the cases due to some form of pressure upon the cortex; naturally the pressure is produced either by a depressed fragment of bone or by blood-clot. In either case symptoms of this kind

lend themselves more than any other to relief by operative intervention. And when the nature and result of the total damage done is such as not to form any insuperable obstacle operation should always be undertaken. Luckily the relief of symptoms of this kind is not always, or even usually a matter of any immediate urgency and one can permit sufficient time for the ample recovery of the patient from the initial stage of shock, or for the improvement of any deterioration in his general condition then at the earliest opportune moment which presents itself the damage is repaired.

The following cases illustrate these various aspects of cranio-cerebral injury.

**Case VI.**—This man of thirty nine years sustained his injury by falling from a truck which he was driving. Although he landed on his head, he was able to walk to the hospital, where, on admission he complained only of headache and dizziness. Shortly thereafter he fainted and went into stupor and the latter alternated with a short period of consciousness. The essential symptoms included a left hemiplegia and the signs of a progressing general intracranial compression. Operation was done within two hours of the reception of the injury and showed an extensive stellate fracture into the base with depression of the fragments and a large extradural hemorrhage. The clot was cleaned out and, after the bleeding had stopped spontaneously the cavity was drained by a strip of gauze and the outer wound was sutured. The operation had an immediate good effect the latter has persisted and has become progressive.

This case is illustrative of a number of important points. It demonstrates a very typical picture. A patient having received a head injury has successive periods of consciousness and unconsciousness which quickly deepens to stupor. The signs of a progressively increasing intracranial compression are associated with the established signs of a focal paralytic lesion these together should in most of the cases indicate to one's mind that the actual lesion is due to hemorrhage. The progressive nature of the intracranial compression created the imperative demand for immediate operation, and the nature of the total injury was

not excessive and permitted an operative interference. The rapid relief of symptoms is characteristic.

**Case VII.**—One hour before admission the patient had fallen down an elevator shaft. The physical examination showed (1) a semiconscious patient in marked shock (2) a large hematoma in the right parietotemporal region (3) bleeding from the right ear (4) a complete left hemiplegia (5) immediate loss of all reflexes which shortly began to return the left reflexes were all exaggerated, there was a left inexhaustible clonus and a right exhaustible clonus (6) signs of compression, the pulse dropping to 44 beats per minute (7) distention of the vessels of both fundi with hemorrhages. Operation was done four hours later and showed a depressed fracture running from the mastoid and temporal bones to the occiput a plum-colored dura and a perforation of the lateral sinus extensive hemorrhage and laceration of the brain. A contralateral decompression was done in addition. There was considerable immediate improvement, but after twenty four hours the symptoms were much worse and a fatality ensued.

In a general way the symptomatology of Case VII was similar to that of Case VI. The nature of the pathology was much different because there was present (1) destruction of brain tissue and (2) injury of one of the venous sinuses. Both of these and especially the latter create very serious lesions, and the total injury is often of such a nature as to forbid any successful outcome. Injuries of the venous sinuses are complications of most extraordinary gravity and in a series of 5 operated cases all but 1 died. The clinical picture includes most often the sign of a progressive intracranial compression. When the sinus is exposed during operation the bleeding is tremendous it is controlled best by muscle tissue excised from the neighborhood and held over the opening in the sinus for a few minutes, when it rapidly becomes agglutinated.

A group of cases with longitudinal sinus injury have been segregated by Holmes and Sargent which exhibit a characteristic symptom complex called the longitudinal sinus syndrome. Holmes and Sargent's experience was derived from the war

work. Cushing has pointed out that these cases have their counterparts in the traumatic spastic paralyses of childbirth—the so-called Little's disease. The pathology includes compression or laceration of the longitudinal sinus or of some of its anastomotic branches in the neighborhood of the motor cortex, with, frequently associated injuries in the paracentral lobules or in the convolutions bordering the fissure of Rolando thrombosis of the sinus is frequently found.

Symptomatically there are two groups of cases, the essential attribute of both being a spastic paraplegia, and the differentiation being made upon the presence or absence of a sensory ataxia. The important feature of the paralyses is the extreme rigidity. In this syndrome pain and temperature perceptions are unaffected and the tactile sensibility is not perceptibly diminished. The power of discrimination of compass points and the deep muscle sense can show marked abnormalities. The sensory disturbances are found most commonly when the injury is some distance behind the Rolandic fissure.

The symptoms need not be permanent, and when there is no brain destruction and the thrombosis is not too extensive compensation can occur during the establishment of a collateral circulation.

**Case VIII.**—This illustrates a very severe form of this injury. The patient, a child of nine years, was struck by an automobile. The neurologic status included (1) unconsciousness, with Cheyne-Stokes' breathing (2) unequal pupils which did not react to light (3) marked spasticity of all four extremities. The site of the injury was on the vertex of the skull. The general condition of the patient was very bad and death occurred four hours later.

**Case IX.**—This boy is eleven years old, and one week ago was struck by an automobile on the left side of the head. The immediate findings included (1) stupor (2) deviation of the eyes to the left with pupils that reacted to light (3) except for some slight increase of the reflexes on the right side no abnormalities in the upper extremities (4) lively right abdominal, and absent cremasteric reflexes (5) marked spasticity of the right

lower extremity so that the leg is bent with difficulty and the reflexes are not elicited satisfactorily on account of spasm (6) a less spastic condition of the left lower limb with exaggerated reflexes and an ankle-clonus (7) bilateral Babinski (8) practically negative fundoscopy (9) a large hematoma of the parietal region. From the symptoms it could be predicted that the lines of fracture would overlay the longitudinal sinus, and so the x-ray showed. As you see now the boy is much better

Cases VIII and IX present extremes of the clinical pictures of cases showing the longitudinal sinus syndrome. Naturally there are all grades in between. Those that have focal symptoms and are in satisfactory condition should be subjected to operation, in any event they are serious cases.

Case IX brings up the subject of the value of fundoscopic examinations in cranocerebral injuries. The fundoscopic examination with regard to the condition of the nerve head is a factor of established value in cases of increased intracranial pressure which are accompaniments of the development of intracranial tumors or abscesses under these chronic conditions the presence of a choked disk indicates the presence of increased tension the successive degrees of which can be compared mathematically with the degree of swelling of the disk. Long periods of time are necessary for such changes. Increased intracranial tension with cranocerebral injuries is an acute phenomenon and never does the swelling of the disk approach the extent seen with tumor or abscess formations. What one does see in a few cases is a blurring of the margins of the disk or at most very slight elevation, which is always too slight to be measured. The demonstration of these fundoscopic changes is rather exceptional with cranocerebral injuries, but when the changes are present they form most important evidences of the presence of increased tension however the other symptoms of a progressive increasing intracranial pressure overshadow so completely the fundoscopic changes that the latter can be accepted only as corroborative evidence. Under ordinary circumstances the other evidence will be sufficient to enable a judgment of the proper therapeutic course to pursue.

Our ideas regarding the proper course of treatment for craniocerebral injuries ought to be determined on the basis of the average results obtained with the conservative and operative forms of treatment. We have found in our experience that conservative forms of treatment average a mortality of approximately 27 per cent. compare this with a mortality of 48 per cent. for the operated cases and with a total mortality of 31 per cent. after all forms of treatment. Some of this difference is undoubtedly due to the fact that patients who are subjected to operation naturally have more severe lesions. For that reason I have tried to emphasize in these remarks that patients should not be operated upon when in very desperate conditions. Let me summarize our ideas upon this subject as follows:

1. Conservative and expectant methods of treatment under proper conditions yield the best results. One should be unalterably opposed to indiscriminate operating upon craniocerebral injuries occurring in civil life. As the cases present themselves for treatment one can distinguish that they fall readily into one of three groups (a) A large group the members of which always recover under conservative forms of treatment (b) a smaller group in which the individual patients have received such serious injuries that they are almost certain to die no matter what form of treatment is pursued and (c) a very small group in which the individual patients present such borderline symptoms as to make a decision of the proper course of treatment—whether conservative or operative—most difficult for these patients a policy of watchful expectancy is most advisable, and one should stand prepared to operate at a moment's notice the final outcome in these cases is always in doubt.

2. Operation is imperative in every case of advancing intracranial pressure and should be done in the early stages and before there is evidence of medullary involvement.

3. Irritative or paralytic focal symptoms pointing to pressure upon or disorganization of definite cortical areas are the next most important indications for operative intervention. Operations in this group very seldom bear the urgency which is a notable factor in the cases in the second group and can be

done more at one's leisure. Isolated or irregular disturbances of neurologic function can be discarded from the therapeutic point of view and for these conservative forms of treatment will yield superior results.

In our experience lumbar puncture has not given complete satisfaction as a therapeutic measure. In mild cases of intracranial compression the release of cerebrospinal fluid has been followed by slight or moderate degrees of symptomatic relief, but in other similar cases the ultimate effect has not been different when no such procedure was practised. In severe and progressive forms of intracranial compression the release of cerebrospinal fluid by lumbar puncture exhibited no decompressive effect, and much more radical and active measures were necessary to obtain the desired immediate effect.

## CLINIC OF DR. MORRIS H. KAHN

### BETH ISRAEL HOSPITAL

#### CANCER OF THE LOWER END OF THE ESOPHAGUS

History of 3 Cases Methods of Diagnosis Clinical Examination The Function of the Surgeon in This Disease

##### CASE I

Family History.—J. L., aged sixty-three, gave a negative family history.

Past History.—He always complained of intestinal disturbances, especially obstruction and constipation. His habits were good. He denied any venereal infection. His weight before his illness was 165 pounds.

Present Illness.—His present illness began one year before he came under observation, with vomiting and substernal distress.

The vomiting occurred five to ten minutes after eating and consisted of the food previously ingested. It never was more in quantity than the amount taken. The vomiting relieved the sensation of pain. At first it took place only after eating solid food. There was no blood in the vomitus. Until a short time before the onset he could retain eggs and milk, and therefore made his diet consist chiefly of these ingredients.

There was a sensation of obstruction behind the middle of the sternum, with dull pain in the same region. He had no abdominal pain, no jaundice and no urinary disturbances. He had an occasional slight cough with mucous expectoration.

Physical Examination.—The physical examination showed a moderate degree of emaciation, a resistance to pressure in the epigastrium, and some enlargement of the pelvic glands felt through the abdomen.

**Clinical Studies.**—Stomach-tubes and bougies were passed from the smallest to the largest size. All of them met an absolute obstruction exactly 16 inches from the teeth. On one occasion there were mucus and blood particles on the tube when it was removed.

The vomitus was alkaline in reaction and showed the presence of many *Bacillus Oppler* bacilli. The stool was negative for blood. The blood count showed a secondary anemia with hemoglobin 58 per cent., and red blood-cells 4,448,000 per cubic millimeter. His weight was 113 pounds, *i.e.* a loss of 52 pounds. The urine showed a faint trace of albumin but no sugar or acetone, and a very occasional granular cast.

The pulse, temperature, and respiration were normal. The lungs showed dulness and harsh breathing over the right apex.

$\pi$  Ray examination of the lungs made when first seen showed a marked infiltration in the roots and throughout the substance of both lungs. The diaphragm was irregular on both sides and raised considerably in the center. The first pair of costal cartilages showed marked ossification. The appearance was one of pulmonary tuberculosis.

$\pi$  Ray of the esophagus made a few days later showed a stricture in the esophagus at the level of the middle of the body of the eleventh thoracic vertebra. Above this the esophagus was very much dilated to the diameter of about 2½ inches (see Fig. 742).

The patient's general condition continued poor for a number of months, with progressive emaciation. There was repeated vomiting few minutes after eating. After a while he was unable to take any solid food. Fluids sometimes also regurgitated. He had no hematemesis.

The abdomen became more retracted and soft. There was a definite mass felt deep in the left xiphocostal angle in the epigastrium. This mass descended with respiration. There was no tenderness over the sternum and no lateral thoracic or other glands palpable.

Six months later the patient continued to suffer as before with forced olive oil, eggs and milk as his only foods. If we

ceeded thus in gaining some weight despite the frequent vomiting, but the weakness increased. For two weeks nothing at all passed through the cardiac end of the esophagus. Whatever food he ate was vomited together with mucus. He grew extremely pale. The pallor, emaciation and weakness were the outstanding features at first glance. There was an indefinite tender tumefaction over the gall bladder region.

The heart continued regular without any murmur. The blood by this time had fallen to 25 per cent. hemoglobin. The red blood-cells showed anisocytosis with megalocytosis. There were no nucleated red blood-cells. The white cells showed 74 per cent. polynuclears and 26 per cent. lymphocytes.

Soon after all fluid intake was stopped by mouth and a nutritive enema was given every four hours, consisting of 8 ounces of peptonized milk, the white of 1 egg, 2 teaspoonfuls of sugar and  $\frac{1}{4}$  grain of coden.

The following month the patient's general condition was very poor. There was emaciation, weakness, and anemia. The mass remained indistinctly felt subcostally in the median line on the left side of the epigastrium. It was considered inadvisable to perform gastrostomy.

The patient died of exhaustion and emaciation about one week later.

#### CASE II

**Family History**—A. K., aged sixty three, gave an entirely negative family history.

**Past History**—He had typhoid and malaria as a boy. He took tea and tobacco occasionally but no alcohol. He denied venereal infection. His weight one year before his present illness was 143 pounds.

**Present Illness**—For one year the patient complained of pain in the pit of the stomach which was burning in character. This occurred about a half hour after eating, lasted about one-half hour and radiated sometimes to both shoulders, but never downward. This pain was not affected by taking food. It occurred at intervals of a few days, but seemed to be increasing in frequency.

For several weeks there was a choking sensation on swallowing solid and even liquid food. He felt as if there were an obstruction at the level of about the eighth dorsal vertebra. Immediately after he gagged, brought up some mucus, and expelled the food. There was never any blood in the regurgitated material. There was no jaundice. He lost considerably in weight.

Physical examination showed a moderate degree of emaciation. Glands were distinctly felt in the right axilla and in both inguinal and epitrochlear regions. The chest showed marked clavicular retraction.

The lungs, anteriorly showed relative dulness in the left supraventricular region, absolute dulness in the right supraventricular region, and relative dulness in the right axilla. The breathing was harsh in the apices. There were a few subcrepitant rales on inspiration, more on the left side.

Posteriorly the respiration was good. There was harsh breathing in both suprascapular regions and in the right interscapular region and prolonged expiration and crepitant rales on the right side. In the median line there was bronchial breathing down to the seventh dorsal vertebra, while resonance was good down to the sixth dorsal vertebra.

The heart apex-beat was in the infravtyphoid region. The sounds were weak and there was a slight systolic retraction of the apex. The pulses were equal, regular and of good force and volume.

The abdomen showed no significant physical signs. The liver perceived from the sixth rib to the free border but was not palpable. A rectal examination showed small external mucocutaneous tags. There was slight prostatic enlargement.

**Clinical Studies.**—Bougies of various sizes were passed and met with obstruction 16½ to 17 inches from the teeth. An Ewald test-meal was ingested without any pain or difficulty and retained for one hour.

A medium-sized stomach-tube was introduced twice and it also met with obstruction 16½ to 17½ inches from the teeth. A colorless, clear alkaline mucus was expelled.

Another Ewald test-meal was ingested with the same results. There was no vomiting or regurgitation this time.

A third Ewald test meal a week later brought up 25 c.c. of fluid after one hour. This showed Free acidity 0 total acidity 12. There were no lactic acid, no blood, and no Boas-Oppler bacilli present. A small tube introduced at that time met with an obstruction at a distance of 16 inches, but then passed on into the stomach. A large tube was obstructed at the same level and it brought up no gross tissue elements.

The Ewald test meal repeated a week later brought up no food after one hour. At this time a small tube passed the structure with difficulty.

Another week later a double Ewald meal was retained for one hour. Through a small tube which evidently passed the obstruction, 50 c.c. of well digested food were obtained. An examination of this showed

Free HCl	0
Total acidity	5
Blood	0
Lactic acid	0
Boas-Oppler bacilli	0

Ferments showed

Rennet	0
Pepsin	Slight.

$\pi$  Ray examination made about this time showed a very slight obstruction of the esophagus. The bismuth roentgen was momentarily arrested at the cardia; it then passed in a narrow stream quickly into the stomach. The latter had a steer-horn shape (see Fig. 741).

Four months later the patient had lost much weight, was extremely nervous, bringing up mucus from the throat almost constantly. He ate well and did not vomit, but his bowels were very constipated. He complained of headaches, abdominal and general pains.

In the physical examination small soft bilateral axillary

glands were felt. There were no Virchow glands. The heart showed a bradycardia of 68. The abdomen showed no mass or tenderness.

Three months later after a week during which the patient was melancholic, he refused to take food or medication. On three occasions he lapsed into a stuporous condition, from which he was aroused with difficulty. He had laughing and crying spells. There was no vomiting or convulsions or any other symptoms.

The physical examination showed his apathetic state and emphysema and emaciation. The stomach-tube encountered an obstruction 15½ inches from the teeth. The patient was fed with difficulty by gavage and subcutaneous infusions of 5 per cent glucose solution. His urine showed a heavy trace of albumin and very much acetone with an occasional granular cast.

Just about nine months after he first came under observation, and one year and nine months after the onset of the illness, the patient died suddenly of cardiac exhaustion.

### CASE III

**Family and Past History**—A. H., aged sixty-four, gave an entirely negative family and past history. He lost 25 pounds in six months. His bowels were normal.

**Present Illness**.—For two months the patient had increasing difficulty in swallowing solid food. He did not regurgitate or vomit, but the food merely took a very long time to get past the cardia. For the last five weeks the passage of fluids was also obstructed.

**Physical Examination**.—The physical examination showed emaciation, accentuation of the second aortic sound and increasing pulse tension. The stools were repeatedly negative for blood. The urine was light amber clear acid, 1026 with no albumin or sugar.

**x Ray examination** made about that time showed an almost complete obstruction of the esophagus at the cardia, only a thin stream of the contrast meal passed through, which was

insufficient to empty the esophagus and it remained filled completely (see Fig. 743).

For two days after the x-ray was taken the patient continued vomiting the meal given for the test. His weight at that time was 140 pounds. He continued under observation a little over two months during which time the obstruction in the esophagus became absolute.

He died following extreme emaciation, marked acidosis and coma.

#### DISCUSSION

The characteristic picture presented by cases of stenosis of the lower end of the esophagus is well exemplified in the series presented in detail in this clinic.

Stenosis is the most frequent and practically the most important affection of the food pipe. New growth is probably the commonest cause of it, and even with early diagnosis it is very difficult to achieve anything to modify the unfavorable outlook. The region of the lower end of the esophagus is almost inaccessible to surgical intervention and usually with late diagnosis the glands at the base of the neck have already become involved. These so-called Virchow metastases would, of course, in any case forbid radical measures.

Although the finding of the stenosis is comparatively a simple procedure amenable to the various mechanical means of diagnosis diagnosing the character of the narrowing offers almost insurmountable obstacles. We will take up each of the symptoms as they are presented in the various cases and discuss them briefly.

It will be first observed that the 3 patients were all men. The disease is more frequent in males than in females. It rarely occurs before the fifth decade the age of our patients is a characteristic period.

**Difficulty in Swallowing**—The first symptom observed in all 3 cases and usually the earliest symptom is dysphagia or difficulty in swallowing. This is at first present only after solid food is ingested. Fluids and soft food will pass unobstructed. Solid food will regurgitate soon after swallowing. Later on, however,

as the part of the esophagus above the narrowing becomes dilated food may remain down for a longer period, or the regurgitation may continue for a longer time. The rejected material consists of the masticated ingesta and is sometimes mixed with a large amount of mucus, rarely with blood. It may also contain cancerous fragments.

**Pain on Swallowing**—Even during its early development the patient will complain of a sensation of obstruction behind some part of the sternum. Sometimes this sensation amounts to actual pain or substernal distress. At other times it is merely interpreted as a pressure of food in its passage through the narrow lumen. The pain may be relieved soon after by vomiting. Later it may be dull and continuous. Sometimes it is burning in character and radiates toward the shoulders or up along the sternum. One of our cases describes it at times as a choking sensation on swallowing solid or even fluid food.

**Deglutition Sounds**.—Associated with this difficulty in swallowing is a sign of some clinical significance. Normally after swallowing there is heard a kind of a rattle along the esophagus, and a few seconds later there is a gurgling sound when the food passes into the stomach. These can be heard just to the left of the lower end of the sternum. If stenosis of the esophagus is present, the esophageal deglutition sound becomes softer and the sound of entering the stomach may disappear.

**Emaciation**.—Loss of weight is one of the important effects of the malignant new growth. Associated with difficulty in swallowing, it usually indicates cancer of the esophagus. The deprivation of food in these instances by the mechanical obstruction need not be sufficient to cause any alarm. Nutrition may be maintained by the ingestion of large amounts of milk for a long period of time. It is only in cases of cancerous obstruction that fluids may still pass into the stomach and yet loss of weight continue unchecked.

In the clinical examination of these patients lies the secret to the diagnosis. However clear the history may be among the tests that should have consideration in the diagnosis are

Passing of esophageal bougies

Examination of regurgitated contents and of test meals.

Finding of remnants of tumor tissue in the washings of the esophageal dilatation.

**$\alpha$ -Ray examination.**

The passing of esophageal bougies is a more or less simple method and is of great value in ascertaining the patency of the lumen of the esophagus and the amount of obstruction at any particular level. The patient is seated as he might be for the passing of a stomach-tube or is inclined in the semirecumbent posture. The bougies are assorted from the smallest size to that of an ordinary stomach-tube, and are one after the other lubricated with albolene and introduced gently into the esophagus. A medium-sized tube may be tested first if that meets with an obstruction, it is removed and a smaller size introduced. Care must be taken not to exert any undue force as the cancerous tissue may be necrotic and friable and damage may be done to that, or a false passage made. The depth to which the tube is introduced must be noted as it indicates the level of the obstruction.

When a small stomach tube or Rehfuss tube enters the stomach the usual Ewald or the Rehfuss fractional test meals are given. The stomach contents will be found to contain less acid than normal or no acid, although the motility may be adequate. The amount of the meal that the stomach will contain will be less than normal a good proportion of it having been retained above the esophageal obstruction or regurgitated.

In the later stages a stomach-tube will not pass beyond the esophageal tumor. In such cases the regurgitated material after any meal will be found to be alkaline containing a large amount of mucus, undigested food, perhaps tumor tissue and frequently blood, and will contain no gastric fermenta.

A fragment of tumor tissue and some blood may be adherent to the end of the stomach-tube or be contained in the lumen at the tip. This should be carefully examined for malignancy under the microscope. Tumor tissue and increase in the amount of albumin contents in the washings of the stomach may also exist due to the peristalsis of tumor material throughout the cardia.

*x* Ray examination is of great assistance in the diagnosis of cancer of the lower end of the esophagus. The bismuth or barium meals ingested will outline the esophagus. It will show its compression with narrowing of its lumen or its complete obstruction by the tumor. Spasm of the esophagus will give an altogether different picture and only a transient narrowing. The forms of obstruction, partial or complete are shown in Figs. 741-743 respectively.



Fig. 741.—Illustrates narrowing of the esophagus by cancer with beginning dilatation above the lesion.

I am indebted to Dr. Charles Gottlieb, radiographist for these plates.

The surgeon's function in this disease is as consultant to decide upon the following questions:

1. The possibility of removal of the tumor.
2. Alimentation by means of gastrostomy openings.
3. Treatment by radium.
4. Feeding through sounds.



Fig. 742.—Shows irregular complete obstruction of the esophagus with dilatation above.



Fig. 743.—Shows complete esophageal obstruction with dilatation of the entire length of the tube to upper end.

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by means of a stomach-tube or small bougie and allowed to act locally. While radium will destroy cancer tissue in a dosage not affecting normal tissue, it, of course, will not cure the disease unless it is quite superficial or of a variety peculiarly susceptible to its influence. The destructive action of radium extends to a depth varying up to 9 cm according to the dosage used and the sensitiveness of the neoplasm. This action, even to the depth mentioned, occurs with a maintenance of relative integrity of the normal tissue traversed. It should be used however only as a supplement, but not to replace the knife except where the cancer is not amenable to operation, as in the location under discussion.

Feeding through sounds may be instituted early perhaps with advantage as later there is danger of a false passage through the esophagus the tissue being more friable. However some surgeons prefer feeding through a gastrostomy wound.

The inaccessibility of cancer of the lower end of the esophagus makes removal an extremely hazardous if not impossible procedure, although several attempts have been made in that direction. The mode of approach is through a posterior thoracic mediastinotomy. Postoperative complications, as shock, pneumonia, and cardiac failure due to the sudden intrathoracic manipulation, are especially likely. Reports in the literature are usually like that of Hauch (Beitr. u. klin. Chir. 1914 xci) who gives an illustrated description of 18 cases of cancer in the middle and lower esophagus in which he succeeded in removing the growth. One patient succumbed to a recurrence a year after successful resection of the cancer in the lower esophagus and cardia. None of the other patients survived the operation for the following few days.

However the condition is discovered usually too late for any such attempt. Surgical opinion is again invoked at a later period when a degree of emaciation has already taken place, when solid food has, perhaps for long been abstained from, and when fluids pass with difficulty. The dominating question is "Will the patient's life be prolonged to a degree sufficient to warrant laparotomy for gastrostomy?"

The mode of death, as we have seen in our cases, has been following extreme emaciation with exhaustion or coma. It is evident, then, that if we can maintain the nutrition of the patient at a higher level a certain amount of relief can be given. Pressure symptoms from the esophagus are not in themselves cause of death, nor have metastases been a prominent cause. Since a gastrostomy operation can be done with comparative simplicity and haste and since alimentation can be readily instituted, gain in weight should be expected, and for a time considerable improvement anticipated. Life can probably be prolonged for two months or more depending upon the promptness with which the operation is undertaken.

At the same time it is desirable to treat the patient with radium. Its efficacy has been amply demonstrated and methods of its introduction sufficiently simplified to permit of its use in every well-studied case. The radium in an ampule is introduced

## CLINIC OF DR. FREDERIC W. BANCROFT

SECOND SURGICAL DIVISION NEW YORK HOSPITAL

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### OLD POSTERIOR DISLOCATION OF THE SHOULDER; CLOSED REDUCTION UNDER ANESTHESIA REDIS- LOCATION, FOLLOWED BY OPEN OPERATION

The patient is a man thirty five years of age. His chief complaint is stiffness and inability to raise his left arm.

Past history is negative. Denies any epileptic seizures.

Present Illness.—Five weeks ago patient dreamed he was wrestling, fell out of bed. On awaking in the morning he was not certain whether he had fallen out of bed or whether he had dreamed this occurred. However he had a swelling in the region of his left shoulder, stiffness around the shoulder joint, and inability to abduct his arm. He consulted an orthopedic clinic, where he was treated for three weeks by electricity under the diagnosis of circumflex nerve paralysis.

Physical Examination.—As you can see, his arm is held closely to his side with a considerable degree of internal rotation. He is unable to abduct his arm without moving the scapula. On examination one can feel the head of the humerus immediately beneath the acromial process, and the anterior lip of the glenoid cavity can be felt in front. There is considerable atrophy of the deltoid muscle and also of the flexors and extensors of the arm. When he attempts to abduct the arm, however, it is possible to feel the deltoid muscle contract, thereby ruling out the diagnosis of circumflex nerve paralysis.

A stereoscopic x-ray (Fig. 744) shows the head of the humerus to be on the same level as the glenoid cavity but immediately posterior to it, and also very clearly shows the internal rotation of the humerus.



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A stereoscopic x-ray (Fig. 744) shows the head of the humerus to be on the same level as the glenoid cavity but immediately posterior to it, and also very clearly shows the internal rotation of the humerus.

Posterior dislocation of the shoulder is a relatively rare condition. It has been divided by most authorities into two types subacromial and subspinal.

These two types are of degree rather than of different character. The subacromial lies immediately posterior to the glenoid cavity and is usually characterized by internal rotation and adduction, while the subspinal type is further back lying be-



Fig. 744.—Re-picture showing posterior dislocation and external rotation of humerus. Arm adducted close to side.

neath the spine of the scapula and is usually characterized by an increased separation of the elbow from the side of the trunk.

Stimson states that the common mode of production of posterior dislocation is pressure backward and outward upon the head of the humerus either directly or through the elbow combined with adduction of the limb across the front of the chest and internal rotation. Such a combination is most frequently found in falls forward in which the weight is received upon the

adducted elbow. It is possible to conceive that these factors might have entered in in this case although the history is uncertain on account of the dislocation having occurred at night time when the patient was more or less asleep.

Two weeks ago under ether anesthesia, the dislocation was reduced by first overcoming the muscle spasm by rotating the arm exteriorly and then drawing the head forward with coun-



Fig. 745.—Open reduction of posterior dislocation of shoulder. Incision.

traction on the scapula. The head was felt distinctly to slip into the glenoid cavity. As this was five weeks after the original dislocation, the capsule was undoubtedly remarkably relaxed due to the old tear and it was easy while the patient was under the anesthetic, to reproduce the dislocation. The arm was put in a Velpeau bandage and an x-ray two days later showed the head to be in place. On removing the bandage eight days after the reduction the head was found to have again become dis-

located posteriorly. For this reason an open operation was decided upon.

In looking up the literature on this subject I have been able to find very little about open operations for posterior dislocation of the shoulder. Anatomically it seems logical to assume that an incision posteriorly with possibly the division of the infraspinatus muscle will expose the joint capsule much more

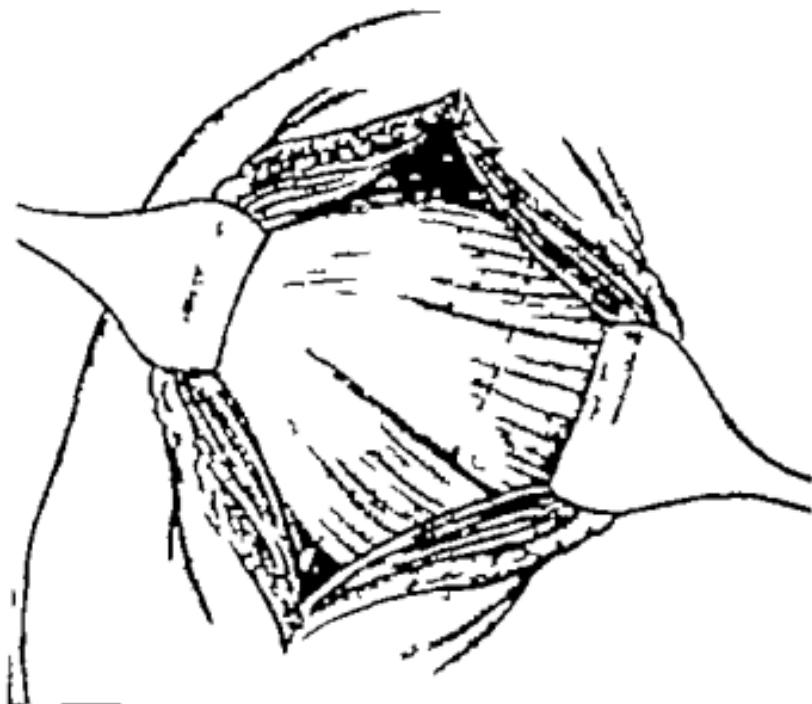


Fig. 746.—Posterior fibers of deltoid separated. Dotted line shows insertion of infraspinatus muscle.

readily than can be done in cases of anterior dislocation operation.

As you see, I am making the incision over the posterior surface and dividing the posterior fibers of the deltoid muscle. Care must be taken here to avoid the circumflex nerve. The infraspinatus tendon now goes directly across our field. We will divide this by putting in Penruddock clamps to identify the two ends of the muscle for future suture. The posterior portion of

the capsule and the head are now directly in the field but by traction with the aid of an assistant and by direct manipulation of the head I can now reduce it into the glenoid cavity and you can see distinctly this large rent in the posterior surface of the capsule. There is now a choice of two procedures for us to adopt

Either (1) to excise this portion of the capsule which is relaxed and suture the raw surface or

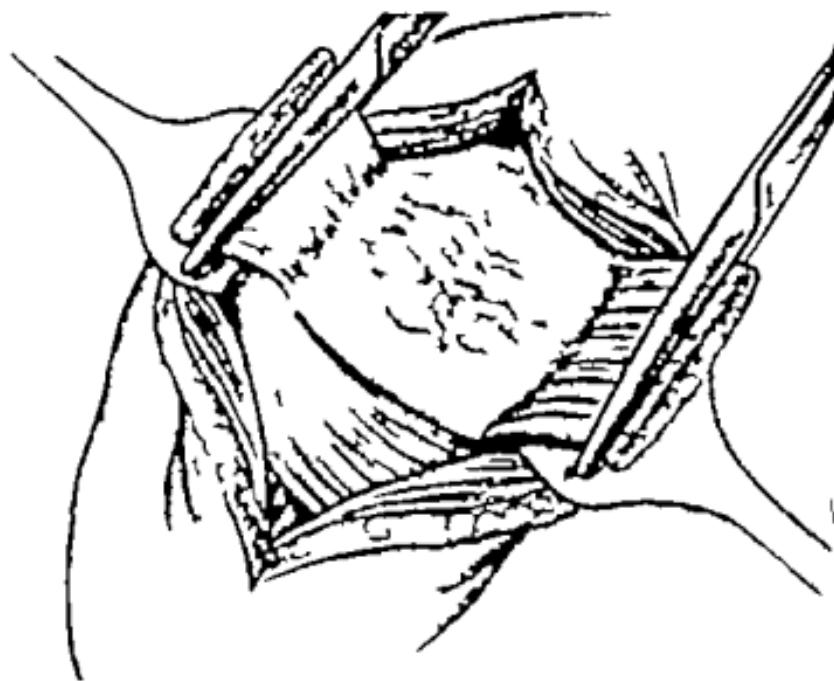


Fig. 747.—Infraspinatus muscle retracted. Rent in capsule shown

(2) To repair this rent by reefing sutures and to repair the tear without opening the joint cavity

Of these two procedures, the latter seems the safer as I feel sure by freshening these surfaces we will gain union of the capsule, and adhesions in the joint are less likely to occur if we do not open it.

We have now inserted six mattress sutures which have taken up the slackness in the capsule and, as you can see, it is now taut

We will now close our wound by suturing the infraspinatus tendon and uniting the fibers of the deltoid which were split longitudinally. The skin will be closed without drainage and the arm put up in a position of abduction 90 per cent. and extreme external rotation to relax the posterior capsule in order to allow healing to take place.

We have two contradictory factors here to fight. We must keep the arm mobilized long enough to allow the healing of the

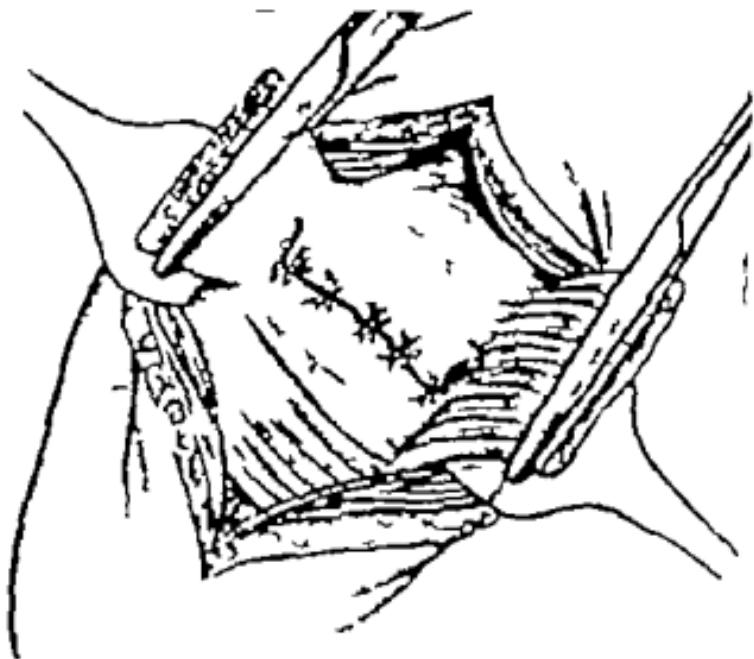


Fig. 748.—Head of humerus replaced in glenoid cavity. Rotator cuff sutured.

capsule, and yet we must start active motion and massage as soon as possible in order to prevent joint adhesions. For this reason I propose to keep him in an abducted position for about four weeks and then start gentle, active motion with massage.

**Condition Five Months After Operation.**—Patient has no limitation of motion neither in external rotation nor in abduction, flexion, or extension. He has had no sign of subluxation of the joint since operation, and the atrophy of his muscles has

completely disappeared. He thinks that the arm is a little bit weaker than his normal arm but is able to perform his normal occupation.

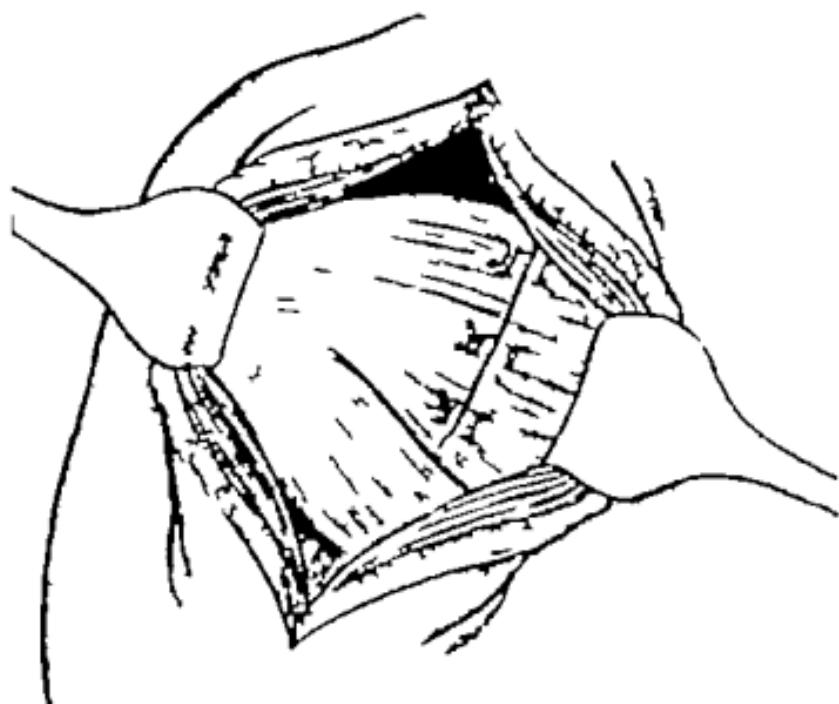


Fig. 749.—Infraspinatus muscle suture immediately before the suture of the deltoid and skin.

He will undoubtedly have to be careful for a certain period of time until this joint capsule is as strong as the other

VOL. —



## GIANT-CELL SARCOMA, LOWER END OF THE RADIUS

Curettage and Insertion of Mossetig Moorhof Bone-wax. Recurrence One Year Later. Curettage and Insertion of Radium. Formation of Secondary Osteomyelitic Cavity with Marked Radial Deviation, Resection of Lower End of Radius and Ulna.

I wish to present this case to you because it is now four and one-half years since the first operation and it brings up many problems connected with giant-cell sarcoma of the long bone.

The patient is twenty-eight years of age, female, single occupation clerk. Admitted to the New York Hospital on June 10 1917. Her chief complaint was a swollen and painful right wrist.

**Present Illness.**—Two and a half months ago the patient fell and sprained her wrist but during the following week there was no pain. Then the wrist became tender on pressure. The tenderness gradually became worse and the patient's doctor thinking the infection came from an abscessed tooth, obtained a culture from her tooth and gave her serum treatment. There was no improvement. About three weeks ago she fell against the window of a car and dorsally flexed her wrist, which resulted in excruciating pain. The terrific pain continued. An x-ray was ordered by her physician and it showed a blur on the lower end of the radius. She was then referred to the hospital.

**Past history** is negative with the exception that two years ago she suffered for two to three weeks from otitis media, and that she has had several abscesses of her teeth during the past year.

**Family history** negative.

Her surgical condition shows a swollen and reddened wrist which is very tender especially over the prominence of the radius and ulna posteriorly. There is scarcely any flexion in

the wrist joint and very slight flexion of the fingers. There is no crepitation and only a brawny induration over the head of the radius posteriorly.

*Pathologist's Report*—Wassermann negative. Blood count, W. B. C., 14,520. Differential polymorphonuclear, 54 per



Fig. 750.—X Ray of giant-cell sarcoma. Head of radius, marked rarefaction of end of shaft. Very little new bone production.

cent. small lymphocytes, 33 per cent. large lymphocytes, 3 per cent. large mononuclears, 9 per cent.

*X* Rays (Fig. 750) show marked rarefaction of the lower end of the radius.

Operation (June 4, 1917)—A long incision, 7 cm. was made over the dorsal surface of the radius. The extensor tendons were retracted. Dismantling through these tendons a consider-

able amount of seminecrotic material escaped through a small hole in the radius. This opening was enlarged and a cavity was found in the head of the radius about  $5 \times 2$  cm. and extending almost to the articular surface. This had a smooth wall which did not bleed. A small rupture had apparently taken place on



Fig. 751.—Photomicrograph of material removed from cavity in head of radius. Shows giant-cells and rather active stroma of the epulis type.

the anterior surface. A considerable amount of a grayish material was curedt out. The cavity was then filled with Moestig Moorhof bone-wax. The tendons and fascia were sutured over the defect and the wound was closed without drainage. Anterior molded splint was applied.

Wound healed with primary union.

Subsequent Admission (April 2, 1918)—Following her discharge one year ago patient had bathing and massage for three months. Pain disappeared and after five months she went back to work. She has had no pain, but has noticed recently that the wrist is beginning to swell again (Fig. 752)



Fig. 752.—Giant-cell sarcoma showing result after first operation. Dark mass is bone. x. November 25, 1916.

Examination at this time revealed the old scar over the dorsal of the right wrist, a diffuse swelling over the lower end of the radius. This was fusiform in shape and bulging on all sides was seen on inspection. There was no redness or fluctuation. There was tenderness over the end of the radius. There was limitation of wrist joint motion in all directions, but no ankylosis. No

Limitation of motion of the fingers. No other bone deformities of the extremities detected.

*Operation* (April 3, 1918) — The same incision was adopted as at the former operation and a reddish tumor mass was found projecting from the radius about 0.5 cm. This mass was excised and the cavity in the radius opened. The cavity was filled with a mixture of bone paste and a reddish friable pulpy mass that grossly appeared like a giant-cell sarcoma. This was curedt out entirely. It was observed that there was a small perforation on the anterior surface of the radius. The cavity was swabbed out with pure carbolic acid and hemostats obtained three cylinders, one containing 50 mm. and two each containing 25 mm. of radium were then inserted into the cavity. The remainder of the cavity was filled with bone wax. The fascia and tendons and skin were united with the exception of a small hiatus through which the radium could be removed. The radium was left in place for five hours. Patient left the hospital on the sixth day postoperative.

Subsequent history was that a small sinus occurred on the dorsum of the wrist. This discharged a small amount of purulent material mixed with bone-wax. The patient was then treated by a radiologist, but developed an extensive x-ray burn so that her hand had to be kept in extension for several months. She was treated in another hospital and amputation advised, but she refused.

Subsequently on my return from the Army I saw her and she then had a persistent sinus with marked radial deviation of the hand due to the collapse of the cavity from a secondary osteomyelitic process (Figs. 753, 754).

The x-rays showed no signs of recurrence of the growth. There was, however, marked limitation of the flexion of the fingers due to the atrophy from the long period of disease when the hand was kept in a splint.

As the x-ray showed a small osteomyelitic process in the lower end of the ulna (Fig. 753 B) it was thought advisable to do a resection of the lower end of the radius and ulna. It would, of course, have been preferable to have resected an inch of the

ulna higher up and then forced the lower end of the ulna upward in order to maintain the styloid process, but this seemed inadvisable due to possible infection of the lower end.

Under anesthesia about  $1\frac{1}{2}$  inches of the lower radius and ulna were resected. The wound was Carried for about one



Fig. 153.—December 3, 1919. (See Case 11.)

month and the wound closed without any sinus. At that time she had pronation and supination through an arc of about 45 degrees, but was able only to flex her fingers so that there was a separation of about 1 cm. between the thumb and the

tip of the index finger. On attempting active flexion of the fingers a marked anemia was shown over the scar on the dorsal surface so that it seemed evident that there were marked adhesions between her dorsal tendons and the skin.



Fig. 754.—x Ray, December 1, 1919. Collapse of osteomyelitic cavity with marked radial deviation of hand and some anterior dislocation.

On May 2, 1921 a fourth operation was done, excising the old skin and scar tissue over the dorsal of the wrist, the tendons were dissected free and a fat transplant from the abdominal wall was placed about the tendons, and the defect closed by a

pedicled skin-flap taken from the forearm. The lower portion of the graft sloughed, but the fat remained in place. She is now able to grasp objects with her thumb and fingers, but is not able completely to flex her fingers. This is partly due to a partial



Fig. 55.—January 29, 1930 (See Fig. 56)

ankylosis of the metacarpophalangeal joints due to the long period of immobilization. She is able to perform her work and is without pain.

This case is presented because the primary tumor was of a type slightly more malignant than the usual giant-cell sarcoma in that the stroma about the giant-cells showed a more active process. While her result at the present time is not complete

functional cure, it is very much more satisfactory than an artificial hand would be, and as four and a half years have elapsed, it seems reasonable to assume that there will not be a



Fig. 756.—*x* Ray after resection of lower end of radius and ulna. January 29, 1920.

recurrence. The *x* ray as you see, shows a slight anterior dislocation of the wrist, but she is able to drive a car, swim, and perform her ordinary duties and earn her living.

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## TWO CASES OF ACUTE HEMATOGENOUS OSTEOMYELITIS OF THE FEMUR

**Case I**—Boy of ten years.

Admitted September 1920 Chief complaint, throbbing pain in the left knee for four days and stiffness of the left knee following a blow to the knee against a stone

*Present History*—Four days ago while playing baseball child struck his left knee against a stone which was being used as a base—"was sliding to the base." The next day the knee began to swell slightly and began to throb. He was unable to put his foot to the floor without pain in the region of the knee-joint. Became unable to bend the knee without intense pain. Condition became progressively worse up until the time of his admission to the hospital.

Child was admitted to the hospital with a temperature of 104° F. pulse 120 respiration 24. White blood count was 22,100 with 87 per cent. polynucleated.

*Physical Examination*—Patient lies in bed with the leg rotated outward and flexion of the knee about 30 degrees. Complains of pain on motion of the knee. There is marked tenderness about the knee and the lower end of the femur. The maximum point of tenderness is on the inner side in the region of the internal condyle of the femur and posteriorly in the popliteal fossa. Deep and continuous pressure over the femur higher up causes excruciating pain. There are several large and tender inguinal nodes. There is a small elliptic abrasion over the internal malleolus of the tibia.

The diagnosis of osteomyelitis of the metaphysis of the femur was made on account of the history and the fact that while there was fluid in the joint the main tenderness was in the region of the lower epiphysis of the femur. The x-ray (Fig. 757) shows a slight fuzziness posteriorly in the region of the epiphysis.



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lateral wound. There was some swelling of the knee joint for a considerable time, but this gradually subsided without treatment. The wound was Carried. The boy left the hospital



Fig. 758.—Lateral x-ray November 3, 1920. Marked subperiosteal and extraosseous bone proliferation. Operative burr holes seen. Ray suggests beginning sequestration.

on the forty-fourth day. The x-rays at this time showed considerable proliferation about the lower end of the femur (Fig. 758) and suggests a possible sequestrum. However from my

*Operation.*—A long incision of the lateral surface of the thigh. Periosteum in the lower third of the femur was stripped from the bone and contained about 2 ounces of pus. On palpation the bone felt roughened externally. On account of the extreme prostration of the patient it was thought advisable to explore the medullary canal. Two burr holes were therefore



Fig. 757.—Case I. Acute osteomyelitis of femur. *A*. Definite area of rarefaction in posterior portion of metaphysis. October 22, 1920.

made along a supracondylar ridge. From the lower one bloody serum with some broken-down fat escaped under tension. As the abscess cavity pointed toward popliteal space it was thought advisable to drain in that region. A small longitudinal incision was made and a tube inserted. Carrel tubes were inserted in the

lateral wound. There was some swelling of the knee-joint for a considerable time, but this gradually subsided without treatment. The wound was Carried. The boy left the hospital



Fig. 758.—Lateral x-ray November 3, 1920. Marked subperiosteal and extraperiosteal bone proliferation. Operative bony holes seen. x-Ray suggests beginning sequestration.

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Follow up (November 17 1921) Wound completely healed for over a year Runs and plays without pain Examination shows linear scar no bone tenderness or induration, no limitation of motion of the knee-joint (Fig 759)

**Case II**—Girl seventeen months of age

Chief complaint tenderness of left thigh.



Fig 760—June 10 1921 Ten days postoperative. Shows some rarefaction.

**Present Illness**—Three days before admission child became fretful and feverish. Parents took her to a doctor who immediately referred her to a hospital. The baby appeared acutely ill and on admission to the hospital had a temperature of 104.2° F pulse 120 respiration 36 White blood count was 20,000 with 91 per cent. polynucleate.

experience in previous cases I feel that frequently bone that appears necrotic in the x-ray will in children become reorganized,



Fig. 739.—February 7, 1921. Coarsening of process suggests well cortical sequestrum. In this case, however, child is running around, feels perfectly well, and has had no sign of ~~some~~ since operation.

and that if the child is progressing well clinically it is favorable to wait for a considerable period of time

subperiosteal. The periosteum was scraped back over the sternal surface of the lower third of the femur. With a drill a



Fig. 762—Case II. July 27, 1921. Marked subperiosteal bone proliferation. Appearance somewhat suggests beginning sequestrum formation.

small hole was made about 4 inches above the lower end. Pus escaped from the medullary cavity. A similar opening was

*Operation*.—Incision was made over the entire length of the left thigh. There was marked edema of the muscles, but in



Fig. 761.—Case II. Ray July 2, 1921. Shows area of operative interference and considerable subperiosteal bone proliferation.

cutting through the deep fascia a large abscess cavity was opened which completely surrounded the femur and was largely

the medial surface below the extensor tendon. Carrel tubes and Dakin gauze were inserted along the side of the femur but none were placed in the medullary canal.

Culture showed a pure growth of *Staphylococcus aureus*.

Child was discharged from the hospital on the sixty fourth day with a normal temperature. The incision was completely healed, but there was a small sinus from the medial stab wound.

Three months after discharge a forceps was inserted and a small cortical sequestrum removed (Fig. 763). As you can see by the intermediary plates there has been marked reaction and new bone production. I am convinced in this case that if the femur had been opened widely and packed an entire sequestrum of the shaft would have occurred.

The wound has now closed completely.

In the treatment of osteomyelitis in children I believe we have entirely different factors to deal with than in the treatment of osteomyelitis in adults, and for this reason I believe that a word of caution is advisable in regard to conservatism as contrasted to the radicalism necessary in osteomyelitis in adults.

In children the bone is much softer the circulation is better and the tendency for osteosclerosis is less. Moreover we have to use extreme caution not to injure the epiphysis.

As Lexer has so graphically shown (Fig. 764) with radiograms, by injecting the arteries with substances resistant to the x-ray the diaphysis, with the exception of the circumferential lamelle, is almost entirely supplied through the nutrient artery. The epiphysis and neighboring portions of the metaphysis receive an abundant blood-supply from the numerous metaphyseal arteries. Therefore in any treatment of acute osteomyelitis in children we must be extremely careful not to traumatize the medullary canal.

The problem is of the same general surgical principles as pus elsewhere in the body that is, relief of pus under pressure. This may be accomplished either by making burr holes into the humerus, or by removing as much of the cortex as may be necessary to promote adequate drainage. Packing and cureting of the medullary cavity should be avoided. If it is practicable

made 1 inch distal, from which pus also escaped. With a gouge the medullary canal was opened between these two holes and a



Fig. 763.—Case II. September 19, 1921. Marked subperiosteal bone production. No signs of sepsis. General condition satisfactory.

considerable amount of broken down tissue was removed from the canal without cureting. A counter stab wound was made on

the infected field with a solution as described by Carrel without injuring the blood-supply.

You will find if this method is carried out carefully that the formation of sequestra can very frequently be avoided and the

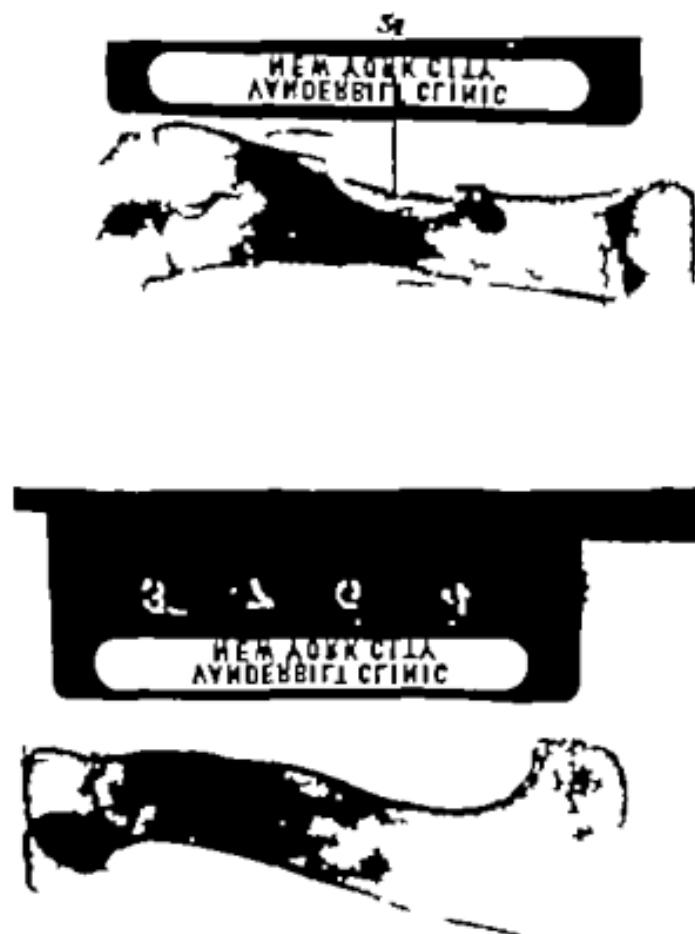


Fig. 763.—Osteomyelitis in dog: 1. section of *Staphylococcus* areas in the medullary canal. 2. Cortical sequestra. Marked new bone production tearing all off medullary canal and compensatory subperiosteal bone proliferation on the opposite side.

long hospital stay greatly shortened. Moreover deformity will frequently be prevented.

In a series of experiments carried on in the Laboratory of

I believe the best method is to lay Carrel-Dakin tubes in the

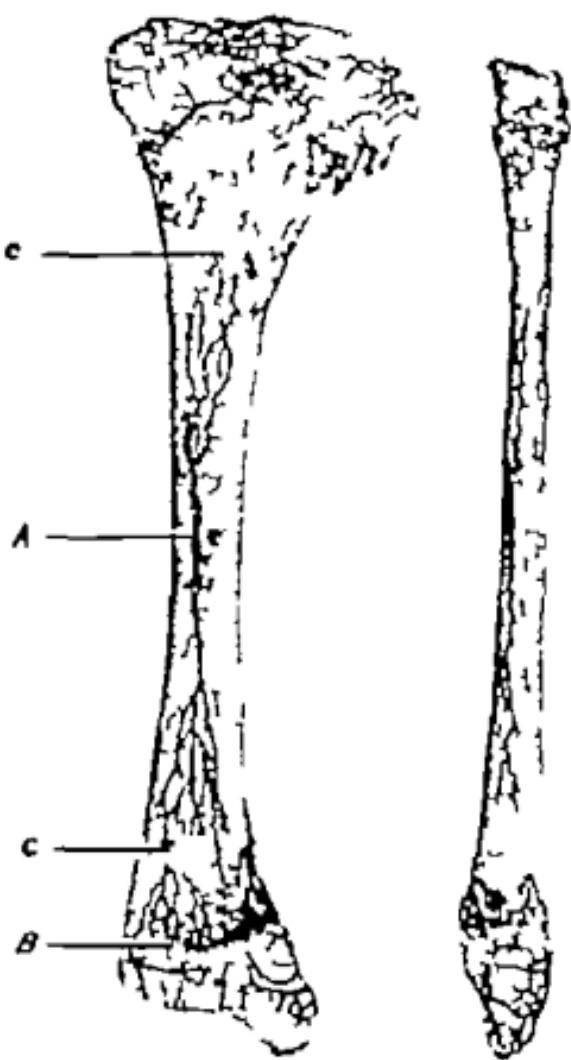


Fig. 764.—Circulation of infant tibia and fibula (after Lewes). A, Nutritive artery; B, metaphyseal and capillary arteries; C, relative vascular zone; here sequestration usually occurs.

immediate vicinity of the shaft, and, if possible, between the periosteum and the shaft. This will allow thorough bathing of

to be incorporated with living bone and to all appearances it was healthy.

Figure 765 shows the process following the production of osteomyelitis in a dog by introducing a strain of *Staphylococcus aureus* that had been obtained from a case of osteomyelitis in a human, and then transmitted through a dog and later injected into the medullary canal of the humerus in a second dog.



Fig. 767.—Low-power photomicrograph. *S<sub>4</sub>*. Cavity in which sequestrum shows granulation tissue with new bone production in the medullary canal; *B* rounded cortex surrounded by mass of leukocytes and infected granulation tissue. (Compare with Fig. 766.)

In these experiments we exposed the humerus, attempting to destroy the nutrient artery and vein by stripping the periosteum from the posterior surface then made a burr hole into the medullary cavity inserted a small piece of gauze soaked in bouillon culture of *staphylococcus* into the medullary canal.

Surgical Research at Columbia University<sup>4</sup> I was able to show that a sterile sequestrum produced by a chemical irritant, such as croton oil, was later reorganized so that by x-ray and gross examination we were unable to detect its former existence. I

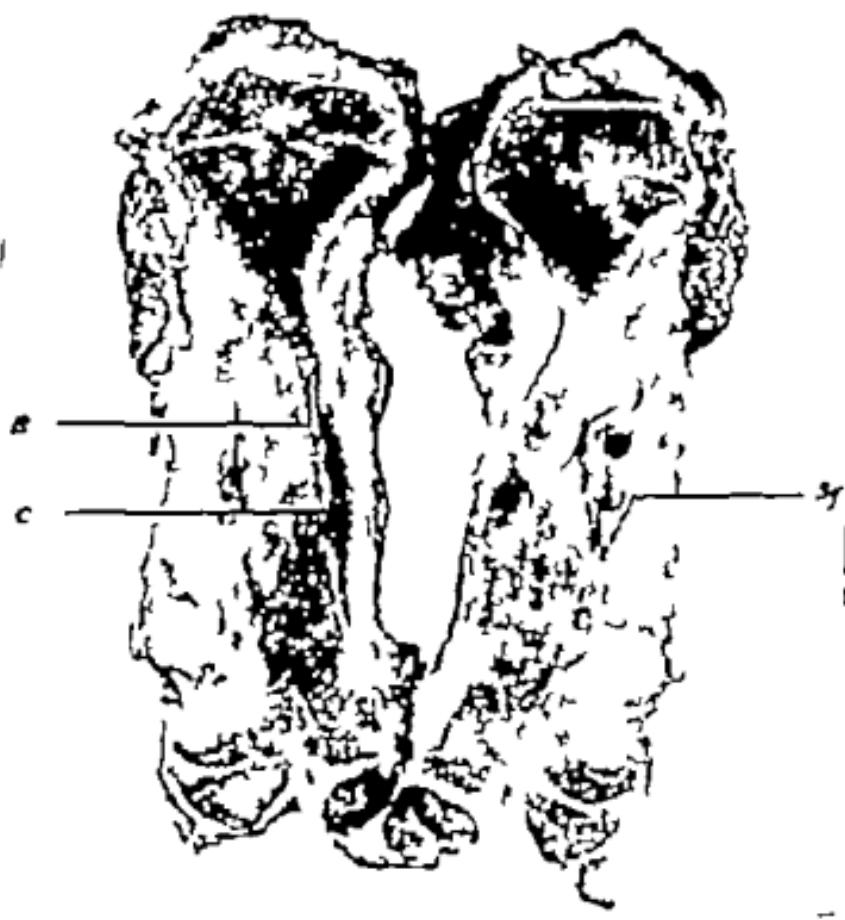


Fig. 766.—Photograph of cross-section. *S* sequestrum. *B* cancellous cortex. *C* subperiosteal bone proliferation.

believe that this condition frequently occurs in children. In the series of cases that we have had at the New York Hospital we have had 2 cases where bone either by x-ray or by gross examination appeared dead but later x-rays showed this bone

face of an infection, attempting to wall off the remainder of the medullary cavity. You will also notice (Fig. 767 *B*) the marked rarefaction of the cortex opposite or distal, to the sequestrum. Peripheral to this rarefied cortex there is a subperiosteal formation of new bone. If we observe closely this area under the high power (Fig. 768) we will see that the cortex is in many places necrotic. The nucleus of the bone-cells are absent from the lacunae, but it is interesting to note that around these areas of dead bone there is new bone formation occurring in the presence of infection as is shown by the pus-cells and infected surrounding granulated tissue.

It is reasonable to assume that these areas of dead bone will not be thrown off as sequestra, but with the gradual overcoming of the infection they will become reorganized and act very largely as bone-grafts.

From the knowledge gained from these experiments I am inclined to believe that a similar process frequently occurs in children, and for this reason we should be guided by conservatism in the treatment of chronic osteomyelitis in children where clinically the case is progressing favorably although x-rays or gross examination suggest the presence of necrotic bone. By carrying out this procedure frequently we will be able to hasten convalescence and avoid deformity. I am convinced from our present knowledge of osteomyelitis in children that it is inadvisable in general to attempt to remove an entire shaft in the early treatment of acute osteomyelitis, as has been advised by some surgeons, for occasionally regeneration of new bone does not occur and we are faced with the problem of either marked deformity or secondary operations necessitating bone-grafts.

plugged the hole with bone-wax, and then sutured the muscles and skin.

Several of the animals died immediately showing all the reactions of an acute staphylococcus pyemia, acute osteomyelitis of the humerus, multiple infarcts of the kidney and occasionally of the spleen. Several of the animals, however, resisted the



Fig. 768.—High-power x-ray of rounded cortex of bone in Fig. 766, B. Shows necrotic bone surrounded by new living bone growing in the presence of an infection. It is remarkable to observe the as the infection subsides that bone would not be thrown off as a sequestrum, but could gradually become reorganized. A Necrotic bone with absence of bone; added B living sub-periosteal bone.

acute infection, and we were able to study the process of chronic osteomyelitis. One animal (Fig. 765) lived for two months with a sinus discharging pus. As you can see by the x-ray, he developed a cortical sequestrum.

It is also interesting to note in the cut section (Fig. 766) the reparative process showing the formation of new bone in the

## TWO CASES OF LOCALIZED BONE ABSCESS (BRODIE'S ABSCESS) ONE CASE OF OSTEITIS FIBROSA CYSTICA, AND ONE CASE OF CHRONIC TRAUMATIC OSTEO-MYELITIS

I AM presenting these cases to you because they illustrate various methods of closing the dead space so common following localized infections in bone.

**Case L**—A woman thirty-eight years of age. Admitted April 22, 1920. Her chief complaint was a swollen, painful right leg immediately above the knee on the posterior surface. Duration of one month.

*Present Condition*—About three months ago without any previous history of trauma, patient began to have pain in the right leg immediately above the knee. At that time she had chills and fever. Says she did not notice any red swelling on the back of the leg until one month ago. She has lost weight and has felt weak and unable to be about for the past three weeks.

*Physical Examination*—Mouth shows a few teeth which are decayed. The gums appear to be normal. The examination is otherwise negative except for the surgical condition.

Over the lower posterior aspect of the right thigh was a large zone of induration, swelling and tenderness. Near the center of this the skin is red and swollen. The swelling is soft and gives a sense of fluctuation. The femur itself is distinctly tender anteriorly and posteriorly over its lower half. The knee-joint is not involved and there are no tender or enlarged inguinal nodes.

*Operation*.—Incision, drainage, and osteotomy for localized osteomyelitis of the right femur. The femur was approached from a lateral aspect. Muscles were split longitudinally and retracted. About the junction of the middle and lower third of the femur on the posterior external surface there was seen an



aspect of the upper third of the right tibia. It is hard, not tender and seems to be in the bone. There is no tenderness either proximately or distally over the tibia and no involvement of the knee-joint.



Fig. 769.—September 24, 1920. Postoperative result of bone abscess, Case I. Shows channelling of walls of cavity so that it is possible for the soft parts to fill in obliterating the dead space.

*Operat. on*—Osteotomy for bone abscess May 14, 1920.

Vertical oval incision with a convexity toward the medial surface. Periosteum was exposed. The periosteum was densely

area about 1 cm. in diameter over which the periosteum was absent. There was a small cloaca in the center. The bone was chiseled away in the region of this abscess and an abscess cavity of small size was seen in the bone. The bone surrounding this abscess cavity was densely sclerosed and was chiseled away with difficulty. The abscess was thoroughly curedt and irrigated with ether. Counterdrainage was then made over the posterior aspect of the thigh in the most dependent portion of the subcutaneous abscess. Carrel tubes were placed down to the bone and in the subcutaneous tissue and muscle. The fascia lata was split transversely so as to avoid occlusion of the drainage tract when the leg was extended.

*The Pathologic Report of the Material Removed by Carrel.*—Microscopically the material consisted of the elements of a chronic progressive inflammation. There is much new connective tissue infiltrated with lymphocytes and plasma-cells. Culture shows a pure growth of *Staphylococcus albus*.

Patient was placed on Carrel technic and left the hospital on the forty third day postoperative. At that time the main wound was completely healed and the counterdrainage wound was discharging a slight serum. She was able to walk without crutches and to flex her knee to a right angle.

Follow up (April 10 1921). Wound completely healed, walks without a limp, has no complaints. Examination. No limitation of motion, no sinus, no tenderness, no bone thickening, and no depression of scar.

**Case II.**—Woman aged twenty-five. Admitted May 13 1920. Chief complaint enlargement of the right leg just below the knee. Duration of seventeen years.

*Present Condition.*—Patient says that when she was about eight years of age the leg became swollen in the region of her present lesion. It was somewhat painful. This pain, however, did not persist long. In recent years it is only painful during bad weather. The pain is not severe and it does not interfere with function. It is not tender on pressure.

Physical examination negative except for the surgical condition. A moderate round swelling persists over the tector

dition. Tissues over the lower aspect of the right tibia are very much thickened and indurated. A small inner healed scar is seen over the inner aspect just under the outer aspect of the internal malleolus. A pockered small, irregular loosened area is seen on the anterior surface of the leg between the region of the tibia and the fibula. A small sinus here is oozing a thin, serous exudate. The lower end of the tibia seems definitely thickened and the overlying tissues here are adherent in places. The normal motions of the ankle-joint are considerably impaired and forced passive motion causes some discomfort.

Wassermann negative

Urine negative for Bence Jones protein.

$\pm$  Ray diagnosis is osteomyelitis of the lower shaft of the right tibia (Fig. 770)

On April 26 1919 Dr. Pool operated. Periosteum was separated from the bone through a 6-inch incision, the anterior surface and considerable of the lateral surface were removed with chisel and rongeur. Bone was markedly sclerosed and a definite abscess cavity was entered in the region of the medullary canal. Carrel tubes were introduced.

Tissue removed from the abscess cavity showed on microscopic examination the presence of dense fibrous tissue heavily infiltrated with plasma-cells which were so numerous as to suggest a plasma-cell ~~syndrome~~ not an abscess. These findings suggest osteitis fibrosa cystica.

Culture—The abscess cavity showed a pure growth of *Staphylococcus aureus*. The wound was then Carreled for sixty-six days.

When smear was last taken it showed about 4 cocci to a field.

On July 1 1919 I removed from the left leg through a curved incision a piece of the tibia about  $0.5 \times 4$  cm. and about 2 mm in thickness. This piece was placed on a dry sponge and the wound was then closed. The skin was excised about the cavity in the right tibia and the granulations curedt. The piece of bone removed was then cut up into small fragments about 1 to 2 mm. in diameter and these were placed in the cavity of

adherent to the bone swollen, with small irregular elevations. The periosteum was scraped off was very thick, and a small cavity about 1 cm. containing thick pus was chiseled into in the region of the medullary canal. The bone surrounding this was ebony in consistency and chiseled with difficulty.

The overhanging walls were then shaved off. The cavity was curedtted. The periosteum was resutured across the bone leaving a stab wound for the admission of four Carrel tubes. Skin and subcutaneous tissues were closed, allowing exit for the Carrel tubes.

Culture shows a pure growth of *Staphylococcus aureus*.

Patient left the hospital on the sixteenth day. There was a small granulating area but no deep tract.

Pathologic report showed a chronic sclerosing osteitis section of the decalcified, thickened bone trabecula without any inflammatory exudate.

April 3 1920 Patient walks without a limp. Discharge ceased three weeks after leaving the hospital. Examination. Wound completely healed. No bone tenderness, no swelling, and the scar is not tender.

*Case III.*—A man aged twenty-five years. Admitted April 23 1919 Chief complaint abscess of right lower leg.

*Present History*—While a school boy in Armenia fifteen years ago he noticed redness and swelling about the ankle. Says he had a fever but does not remember any cause for this condition, which kept him out of school for a year. He was in bed for some time and then went about with only slight disability. Swelling, however, persisted and pain was present usually after being on his feet for long periods.

About nine years ago the abscess broke and a small piece of bone came out. Remained closed then for four years.

For the last three years there has been an intermittent discharge of a thin watery yellowish fluid. Frequently closes during winter and becomes open during the summer. There has never been any impairment of motion in the ankle. Otherwise his general condition has been good.

Physical examination negative except for the surgical con-

2 x 5 cm. was excised. This was sutured over the bone cavity and the skin edges were then united over this with silkworm-gut and silk.



Fig. 771.—Photograph of cavity after treatment with Carrel-Dakin solution and previous second operation.



Fig. 772.—Lateral view after insertion of bone-chips in cavity to obliterate dead space. Bone fragments distinctly seen.

There was some separation of the skin following the operation and a portion of the fascia lata also sloughed but the bone cavity was not infected and by Carreling the surface the

the bone. As the skin layer in this region was thin, due to former scars, and as it was impossible to draw a satisfactory flap over this region, it was thought advisable to first bridge



Fig. 770.—Case III. April 24, 1919. Osseous fibrous cyst of lower end of tibia. *A*, Definite areas of nonunion with some bone proliferation at the cortex.

over the cavity with a *fascia lata* transplant in order to prevent direct contact of the bone-chips lying in blood-clot with a traumatized skin. An incision was therefore made in the left thigh and a *fascia lata* flap with the surrounding fat about

bone-chips have caused a production of new bone about them and a dead space has been completely obliterated.

*Comment.*—At the time of operation his case was diagnosed as a bone abscess by the pathologist's report, and later history would suggest that it was a case of osteitis fibrosa cystica.

The onset of this disease is rare after twenty years of age. It is chronic and tends to lead to a bone-cyst. In the intermediary stages there frequently are cellular elements which are either spindle-cells of the connective tissue type or round cells, which are considered by some to be endothelium and by others as plasma-cells. The tissue has frequently been wrongly diagnosed as sarcoma. The disease has a tendency to extend gradually and in the last x-ray taken of this case there is a slightly rarefied area above the old tumor which suggests a possible extension. When last heard from two weeks ago this patient was feeling well. There was no sinus, but, unfortunately he has gone to Europe and further trace of him will be difficult. The pathologist's report in this case suggests strongly the diagnosis.

*Case IV*—A man aged thirty. Chief complaint limitation of motion in right knee-Joint pain in the right knee on flexion or extension of knee.

*Present Illness*—Fifteen years ago the patient was kicked by a horse while he was in Greece. He was taken to a hospital where he remained for one year. It is evident from his history that at that time he had a compound fracture of the upper third of the tibia. For the last fourteen years he has always had some limitation of motion and pain on walking.

Physical examination negative except for the surgical condition. The right leg below the knee shows a bowing with angulation at the upper third of the tibia and fibula. There is a wide scar on the anterior surface over the tibia entirely healed. No sinus. Over the upper third of the leg there is an area of tenderness about 3 inches in diameter between the tibia and fibula. There is limited flexion in the knee-joint, but no pain on motion. This area fluctuates and is tender on pressure.

Patient admitted on July 2 1920

wound granulated over and on discharge patient had a very small sinus.

He was readmitted in May 1920 because he had a small sinus, but the sinus was curedt and found to lead down to a small cortical cavity in the bone, which was lined with granu-



Fig. 773.—Anterior-posterior view of Fig. 772. Bone fragments distinctly seen.



Fig. 774.—April, 1921. Marked new production of bone obliterating cavity. Disappearance of bone-chips.

lation tissue. Bone about it appeared normal and no fragments could be seen.

Cavity was swabbed with carbolic acid and the wound closed without drainage. Obtained a primary union, and since this time he has been well. As can be seen by the x-ray the

to succeed where in another similar procedure failure might have resulted.

In Case IV an old chronic cavity with a relatively non-virulent organism a fat transplant was inserted without previous



Fig. 775.—Bone fragments transplanted to bridge defect in radius of dog. High-power view of bone fragment six cells after transplantation. Active bone-cells as seen about the haversian canals. When the circulation has not been established nuclei are absent.

sterilization because it was felt that with the surrounding skin so traumatized if the wound were left open there would be marked contraction and it would be very difficult to cover this cavity. The skin sloughed to a certain degree but the fat transplant remained in place and the patient is now well and

July 3d Vertical incision about 4 inches long was made over the fluctuating area. About an ounce of thick, greenish pus was evacuated. Two Carrel tubes were inserted. Culture at this time showed a pure growth of *Staphylococcus aureus*.

The case was treated by Carrel for one week. A week later the previous incision was enlarged and a small cloaca was found on the under surface of the tibia extending into the bone and upward toward the head. It was thought advisable to enter this cavity through the tibia tubercle. Therefore a transverse incision was made exposing the medial surface of the tibia. With a gouge and hammer the cavity was opened into and a dirty granulation tissue removed by the curet. Fat removed from the buttocks was transplanted into the cavity and the skin was sutured over.

*Postoperative History*—The portion of the skin-flap which had been the seat of the previous scar and was adherent to the bone sloughed, but at no time was there any discharge of fat. When the patient left the hospital on his twenty-fourth day postoperative the wound was clean and granulating.

February 2 1921. Wound has been closed for two months. Returned to work three days after leaving the hospital. No pain or swelling. Examination N sinus. Wound clean. No bony tenderness. General condition good.

I have presented these 4 cases because they present different problems in the treatment of infected dead spaces in bone.

In Cases I and II the surrounding tissues could be so drawn over the cavity that obliteration could be hoped for by sheathing the edges of the cavity and allowing the surrounding space to fall in after sterilization by the Carrel-Dakin technique.

In Case III (Fig. 771) there was a large dead space in the lower end of the tibia with a surrounding skin which had been infected for a long period and was thickened and brawny and it would have been difficult to transplant any skin flap to cover this area. In this case we used bone-chips with the idea that they would stimulate osteogenesis. It might have been more advisable to use a fat transplant but we were fortunate enough

secondary operation, he finds that the cut section of the graft bleeds and that it has the general appearance of living bone. Radiographs taken also show the graft appearing as normal bone.



Fig. 777.—Low-power view of transplants bridging defect in radius. A, Ulna; B, radius; C, transplants surrounded by new bone proliferation; D, zone of cartilage (tk) tendency toward false joint formation.

The laboratory worker on microscopic examination finds in grafts of one to two weeks duration that the nuclei do not stain and the bone appears dead. Microscopic examination at a later period shows blood-vessels re-established in the Haversian canals and about them one to two layers of living bone-cells.

about without any sinus, and appears in very good condition. Dr. Walton Martin, of New York, has described this method of fat transplants in a paper read before the New York Surgical Society on October 8, 1919 and published in the *Annals of Surgery* January 1920.



Fig. 776.—Low-power view of transplant surrounded by new bone and cartilage arising from granulation tissue. A, Transplant; B, new bone or fibrocartilage.

Relative to the small bone transplants used in Case III, it is interesting to note how the clinician and the laboratory worker have differed in their accounts of the after history of a graft.

The clinician has usually stated that bone-grafts live because if occasion should arise that it is necessary to perform a

In a series of experiments lasting over two or three years I transplanted small bone fragments 1 to 2 mm. in size into a defect of 3 to 5 cm. of the radius of dogs. Microscopic studies taken at various lengths of time after the operations show in the early



Fig. 779.—Low power, six months after insertion of transplants in defect of radius. *A* The *B* radius. Transplants no longer liable. Tendency toward the re-establishment of the medullary canal. *Itb* complete union.

stages absence of the nuclei in all of these grafts. There is, however, marked new production of bone about them in the granulation tissue produced immediately after operation. Firm union was the ultimate result in nearly all of these cases, and

While portions of the graft apart from the canals show the absence of nuclei (Fig. 775) the process then continues as a



Fig. 778.—X-Ray one year after insertion of transplants. A Area where transplants were inserted. Complete union has occurred and impossible to detect outline of former transplants.

gradual absorption of the dead bone and the formation of new bone in its place.

It is easy to see that the bone at this period would bleed on section and would clinically appear living.

## CLINIC OF DR. WALTON MARTIN

ST. LUKE'S HOSPITAL

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### OSTEOSARCOMA OF THE CLAVICLE AND RETRO- PERITONEAL SARCOMA

I AM presenting 2 patients on whom I have recently operated for sarcoma, with the purpose of discussing prognosis and treatment.

The first patient is a man fifty three years old, who came to the Out patient Department about six months ago to be treated for a swelling of the sternal portion of the clavicle accompanied by pain in the arm and neck (Fig. 780).

About a year and a half ago he was struck by a crate in the clavicular region. Two or three weeks later he noticed a small, painful swelling at the site of injury. He consulted a doctor and was given a salve to apply. The lump continued to grow and the pain increased. His general health was good he was able to work.

Examination at that time showed a swelling about the size of a walnut over the sternoclavicular joint and extending laterally along the clavicle for 4 or 5 cm. The skin over the enlargement was freely movable and but slightly reddened. On palpation the mass felt tense over the upper portion, in places almost fluctuating over the lower portion it was firm and as if made up of a thin shell of bone. There was no local heat, no tenderness on pressure, or abnormal mobility in the clavicle. When the man raised his left arm pain was felt along the side of the neck and over the clavicle.

The patient was a small, lean man, with good color of skin and mucous membrane. The temperature was normal and there

at the end of a year it was impossible to detect the former bone fragments, and the medullary canal was becoming re-established (Figs. 776-779).

I wish to express my thanks to Dr. Eugene H. Pool, Chief of the Second Surgical Division, for the privilege of presenting these cases.

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The patient was a small lean man, with good color of skin and mucous membrane. The temperature was normal and there

were no other lesions of joints or bone or lymph-glands. Examination of the lungs and heart was negative. The Wassermann test was negative. X Ray examination (Fig. 781) shows an area over the inner half of the clavicle about 4 to 5 cm. in diameter where the normal shadow cast by the bone is lost. This area of lessened density is sharply marked off by a dark line at the lower and medial portion.



Fig. 780.—Sarcoma of medial end of left clavicle.

In making the diagnosis we considered tuberculosis of the sternal end of the clavicle, the sternoclavicular joint, syphilis, bone-cyst, and neoplasm.

Tuberculosis of the sternoclavicular joint or of the sternal end of the clavicle occasionally occurs, but it is very rare for this joint alone to be involved. There are usually other easily recognizable lesions. At the end of two or three months the skin would probably be involved with pustulation and the

formation of the characteristic tuberculous fistula. The x-ray plate shows neither new formed bone nor dead bone.

Localized syphilis of the clavicle hereditary as well as acquired is not uncommon. It usually attacks the sternal end. It is the lesion we first thought of on seeing this patient, and not considering a negative Wassermann test sufficient evidence of the absence of luetic infection, we advised a course of anti-

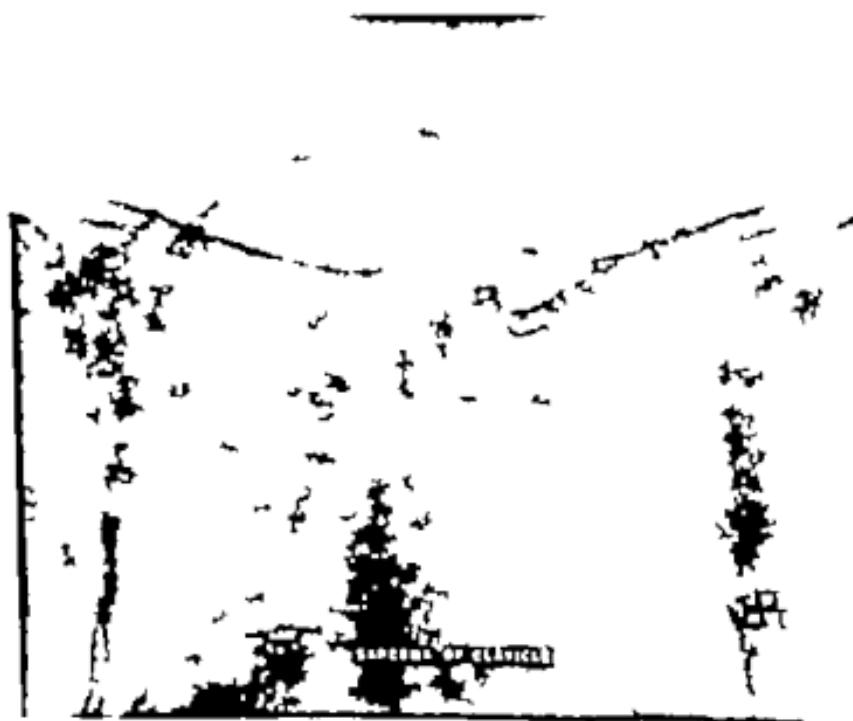


Fig. 781.—Ray plat of sarcoma of clavicle. Arrows indicate sit of lesion.

syphilitic treatment. This treatment was carried out for six weeks without any appreciable effect on the focus of disease in the clavicle. Here again the x-ray plate shows neither sequestrum nor sign of bone hypertrophy.

Cysts of the clavicle have been described. Some of them as in other bones, are parasitic, like the echinococcus cyst; some are possibly infectious, others are cystic neoplasms. The x-ray plate should show however a distinct entire bony capsule.

In Fig. 782 we can easily see that the bone is destroyed in one part.

We were therefore led to the conclusion that the swelling in the clavicle was a new growth.

Of the new growths of the clavicle, sarcomata are by far the most common. Johansson, in 98 reported cases, found that 92 were sarcomata. In this instance the swelling had grown slowly. At the end of a year it was only 1 inch wide and about 1½ inches long. There was apparently no infiltration of the neighboring cellular tissue. We therefore made the diagnosis of a rather slow-growing sarcoma.



Fig. 782.—Medial half of clavicle with tumor.

A skin incision was made along the clavicle from the sternoclavicular joint to the juncture of the outer and middle third of the bone, the middle of the bone exposed, and a blunt elevator passed beneath it, keeping outside the periosteum. The bone was then cut through with a Gigli saw; the clavicular insertion of the sternocleidomastoid above the tumor was divided, the pectoralis major was severed close to its attachment, the medial portion of the divided clavicle was lifted up by a retractor and the clavicular fibers of the sternohyoid muscle and the costoclavicular ligament were cut and the sternum was freed through close to the sternoclavicular articulation. The upper

portion of the tumor mass was freed by dissection and the sternoclavicular joint, the clavicle and the tumor removed in one piece (Fig. 782). Too much muscle had been removed to enable muscle suture of the severed edges and considerable space was left where the tumor had lodged. Bleeding points were ligated and a small rubber-dam drain inserted. The skin was closed with horsehair.

The drain was removed on the third day and the stitches on the eighth. He had little pain and very slight reaction following the operation. He left the hospital with the wound soundly healed.

The macroscopic examination of the specimen removed showed the sternal half of the left clavicle and included the tumor which involved the medial third of this bone, and had caused considerable erosion and destruction of the sternoclavicular joint. The neoplasm measured about  $3.5 \times 4.5 \times 2$  cm. and was moderately well encapsulated. The globular portion, which completely replaced the bone was very soft, breaking down readily and leaving a cavity lined with yellowish, cellular tumor tissue adherent to the thick capsule. The lateral portion of the growth had caused a widening of the shaft and marrow cavity the latter being solidly filled with the tumor. In these areas it was not vascular but fairly firm and compact. I show a photomicrograph from a section through the tumor tissue (see Fig. 789).

After leaving the hospital he has been given x-ray treatment. He has very little disability the partial or complete removal of the clavicle causing astonishingly little disturbance of function of the arm.

The second patient is an Italian woman thirty-one years old. She is rather poorly nourished, but does not look seriously ill. On examining the abdomen, three long linear scars are seen one through the right rectus, one through the left rectus, and one in the middle line. The abdominal wall is lax the skin is wrinkled. On palpation there is a feeling as if there were a large, soft mass in the left side of the lower abdomen and a second one in the epigastric region.

She has been operated on four times the first time at the Italian Hospital for an abdominal tumor I have no record of this operation. In September 1917 she was operated on a second time by Dr. Downes, and a large soft, oval tumor was found in the retroperitoneal tissue below the lower pole of the kidney. She returned in January 1919 looking still fairly well but complaining again of tumors in the abdomen. A mass could be readily palpated in the lower left abdomen. I operated on her



Fig. 783.—Photomicrograph of round-cell sarcoma of the scapula. The photograph shows one of a number of areas in which there are cellular division.

at this time and removed two soft tumors—one from the retroperitoneal tissue at the root of the sigmoid mesentery and one from between its folds. The larger mass was thinly encapsulated, lobulated, soft, and measured about 13-10 cm. It gave the appearance of a very soft lipoma but was more yellowish gray and much less firm than the usual lipoma. Thin sections through the tumor were almost translucent and gelatinous.

After each operation she made a rapid recovery. After her

ing the hospital x-ray treatment was begun at fourteen-day intervals. She was sent back to me from the x-ray department in August of this year because two tumor masses had been felt and seemed to be increasing rapidly under the x-ray treatment.

I operated a second time making her fourth operation, and removed a large mass from beneath the cecum, a second one from near the root of the mesentery of the small intestine and a third and fourth mass from between the mesenteric folds close



Fig. 784.—Myxoliposarcoma.

to the bowel in the lower portion of the ileum. I could feel another mass beneath the descending colon, but feared to disturb so much of the retroperitoneal tissue. She made a good recovery from this operation but for three or four days was much distended and showed signs of paralytic ileus.

The mass beneath the cecum was large measuring 27 x 15 x 8 cm. The others measured about 12 x 8 cm. They were all

very soft, looking juicy and succulent on section, and of a paler yellow than a lipoma. They were slightly lobulated (Fig. 784). In each instance the peritoneum was divided over the mass and then the mass peeled out by very gentle, blunt dissection. I was fearful of tearing vessels, but succeeded in removing the

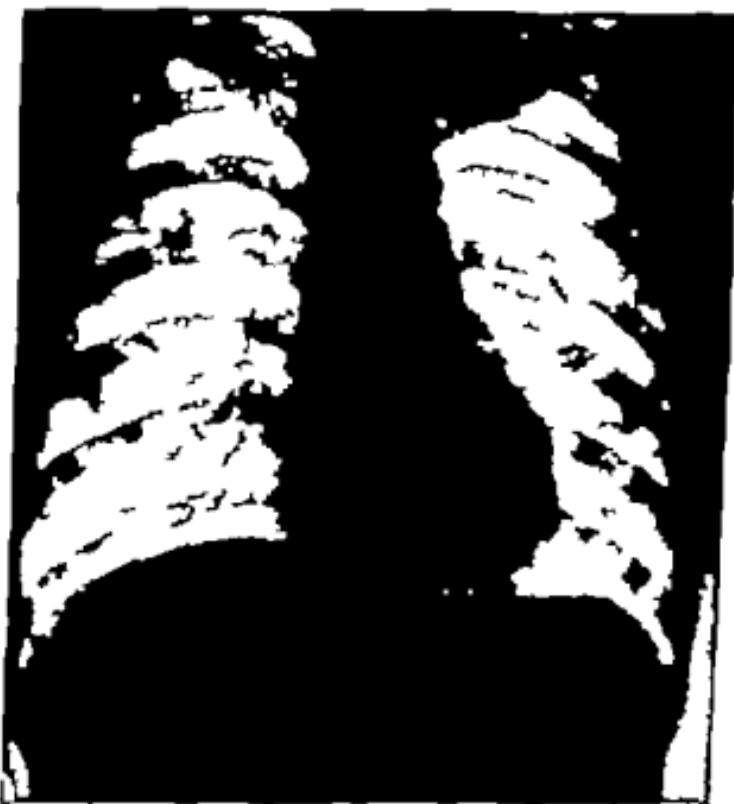


Fig. 785.—Metastatic myxoliposarcoma in dog. Arrows indicate lesion.

four masses without much difficulty and with surprisingly little oozing.

These retroperitoneal myxoliposarcomata are uncommon. Adam, many years ago collected 42 examples from the literature. One was reported in 1920 by Hinch and Wells. The tumor removed at the first operation has often not been considered malignant. The growth is not controlled by the x-ray even in large doses. A wide excision after they have become established

is impossible on account of their anatomic situation. Probably in the blunt enucleation of the tumor masses of neoplastic cells are left behind. When they are multiple, as in this case, one may only be removing protrusions from the main tumor mass. The presence of the large abdominal mass, the absence of nearly all symptoms, and the fairly good general health until the tumor becomes very large are characteristic features. During the period



Fig. 784.—Photomicrograph of section of central sarcoma, another area showing very suspicious interstitial tissue of the osteoid type with beginning calcification.

of four years in which this patient has been under observation she has borne 2 healthy children.

I show a photomicrograph of this tumor (see Fig. 790).

I should like now to refer to 2 more cases of sarcoma that have come recently under my observation. One J. N. had a mass in the upper end of the tibia. It was scooped out thoroughly in June 1919 and then treated vigorously with radium. Finally an amputation was done through the thigh. In January 1921 x-rays taken of the lungs showed metastases (Fig.

785) He died last summer. Sections of the growth removed at the first operation showed giant-cells, but they were less numerous than in the usual benign myeloid giant-cell tumor and the whole growth was more vascular (Figs. 786-787).

The second a boy W. S. had a tumor of the shoulder & Ray examination showed a lesion of the scapula (Fig. 788). Microscopic examination of sections, taken from a piece of the tumor removed for diagnosis, gave the appearance of round-cell sarcoma. I show the photomicrograph and give the report



Fig. 787.—Central sarcoma. In this area the tumor is seen to be distinct from the relatively benign type.  $\times 120$ .

of Prof F. C. Wood (Fig. 783). He was advised to have radium or x-ray applied, and was taken by his family to Dr. Bloodgood. The tumor has disappeared under this treatment.

The relation of these cases, each managed in such different fashion, brings up for discussion the question of treatment and prognosis. We all recognize that under the heading of sarcoma is included a group of tumors of widely different significance. The myeloid or giant-cell tumor like the basal-cell epithelioma

in the carcinoma group for example is generally recognized as relatively benign, and a far less radical treatment is necessary. The histologic type of the tumor should then always be known.

Unfortunately this simple statement needs to be qualified. The distinction between different types is not sharply defined.



Fig. 781.— $\rightarrow$ -Ray photograph of round-cell sarcoma of scapula. Arrows indicate lesion.

There are many transitional forms. Different parts of the same tumor may show widely different structure. The experience and judgment of the individual pathologist is as important a factor as the experience and judgment of the clinician.

In the first case reported we did not cut into the tumor to obtain a piece for examination. We felt fairly sure of the diag-

nosis of sarcoma. And even if the tumor had been a giant-cell sarcoma, I should still have preferred to excise the growth rather than to scoop it out. The shell of bone was incomplete. After thorough cureting the continuity of the bone would have been broken and the resulting disability the same as if the clavicle had been excised nor do I believe the removal would have been as complete.

In the fourth case we cut into the tumor and removed a piece for microscopic examination. The growth was in the scapula and was as large as an orange. Wide removal would have necessitated the removal of the scapula and the muscles attached, with the resulting disability. Had the section shown a myeloid tumor it would have been better to do a far less radical operation. Of course there is the risk of transplanting tumor-cells by this procedure. I do not believe the danger is great, however. Transplanted cells have probably a lower vitality than the original cells. Furthermore the mechanical factors after excision are unfavorable for the lodgment and growth of detached tumor-cells they are washed away by the blood and lymph flowing from the wound.

The microscopic sections in this case were sent to two pathologists. I have shown the section and given the report of one. The tumor was considered highly malignant the tumor-cells seemed already in the blood-stream. Local removal, even amputation of the entire upper extremity would, we thought, afford only temporary relief. Furthermore it was said by Prof. Ewing, the second pathologist who examined the tissue to be of a type yielding readily to radium treatment. The tumor is, I am informed no longer palpable. Whether its disappearance is permanent or not remains to be seen.

In the first case we excised the tumor and then applied Roentgen rays, and this brings up the question of the treatment by x-rays after excision. It is done on theoretic grounds. We have as yet no comparison of a large group of cases treated by excision, then treated by x-rays, and a group treated by excision alone. It must be years before any such comparison can be made. But in every removal it is possible that groups of tumor

cells may be detached and transplanted into the sound tissue. It is certainly true that we occasionally see recurrences in the scars of the needle punctures made in closing the wound after excision of a malignant tumor. It is reasonable to suppose that the x-ray treatment may prevent some of these grafted tumors. Of course in the excision of a neoplasm, even in anatomic regions where we can dissect through sound tissue well beyond the viable growth we have no means of detecting the invisible strands and filaments of tumor-cells extending out into the tissue spaces and along the lymphatic vessels. It would be very satisfactory if we had at our disposal an agent that would destroy any neoplastic cells left behind by cutting across some of these unrecognizable, outlying portions of the tumor an agent that would not damage or destroy the normal tissue cells.

But radium in massive doses did not check the growth of tumor-cells in the third case reported, and the microscopic appearance of this tumor as you can see (Figs. 786-787) was such that it might readily have been grouped with the less malignant giant-cell tumors. Nor have Roentgen rays, even in long-continued and large doses, affected the growth in the second patient I show.

Where excision is possible through sound tissue I should prefer excision, and when we have made as thorough removal as possible, then I should think it might be wise to use x-ray treatment for the reasons I have stated.

In tumors, where the histologic type is generally recognized as benign, I should still prefer mechanical removal unless this removal were disfiguring. In patients in whom the situation of the tumor would necessitate a perilous and very mutilating operation and in whom, at the same time, the histologic type of the tumor would suggest a very bad prognosis, I should prefer to have the patient treated by radium or x-ray.

These questions in the end must be decided by the judgment of the individual surgeon and must change as our knowledge grows of the action of different agents on tumor tissue and a sound conclusion will only be reached when we know the histologic type of tumor and have had an opportunity to watch the

patient for a number of years. It is not satisfactory to speak of curing sarcoma by operation, by radium, or by x-ray. One must know the type of the sarcoma and the duration of the cure. On the other hand, the recession of a tumor and the return to health for a few months is well worth while.

The rapid disappearance of certain sarcomata when treated by radium is surprising. Possibly the radium acts by damaging the endothelium of the new formed blood-vessels in the tumor.



Fig. 789.—Photomicrograph of cellular fibroma or fibrosarcoma of clivus.

causing a thrombosis of the vessels, which in turn, brings about the death of the tumor-cells. Unfortunately after a period of regression, the sarcoma is found to be growing again as if the outer layer of cells in immediate contact with the sound tissue had been unaffected by the rays.

The permanent cures by radium or x-ray seem largely to be in the group of new growths in which satisfactory results have been obtained by curetting, by destruction by chemicals, by cauterization, or by the intense cold of liquid air or even the lens

active carbon-dioxide-know. It is interesting to see that in each of the tumors shown there might have been a disagreement as



Fig. 790.—Myxoliposarcoma of the retroperitoneal region. The tissue is not very cellular and except for knowledge of clinical cases of these tumors, and the fact that there is great irregularity in the size of the cell nuclei, the tumor would not be diagnosed as sarcoma. A number of fat cells are well shown.

to the degree of malignancy judging by a microscopic study of the sections. In two of them, the first and the last, no true decision can as yet be made.



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